CONSTANT CURRENT TRANSFORMERS

FOR

MAZDA STREET LIGHTING SYSTEMS

GENERAL ELECTRIC COMPANY
SCHENECTADY - NEW YORK

Y-685 Aug. 2, 1915
Classes 88-98

CONSTANT CURRENT TRANSFORMERS

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GENERAL ELECTRIC COMPANY
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Y-685 Aug. 2, 1915
Classes 22-26

CONSTANT CURRENT TRANSFORMERS

GENERAL INDEX

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GENERAL INFORMATION

TYPES RJ AND RB
CONSTANT CURRENT TRANSFORMERS

CONSTANT CURRENT TRANSFORMERS

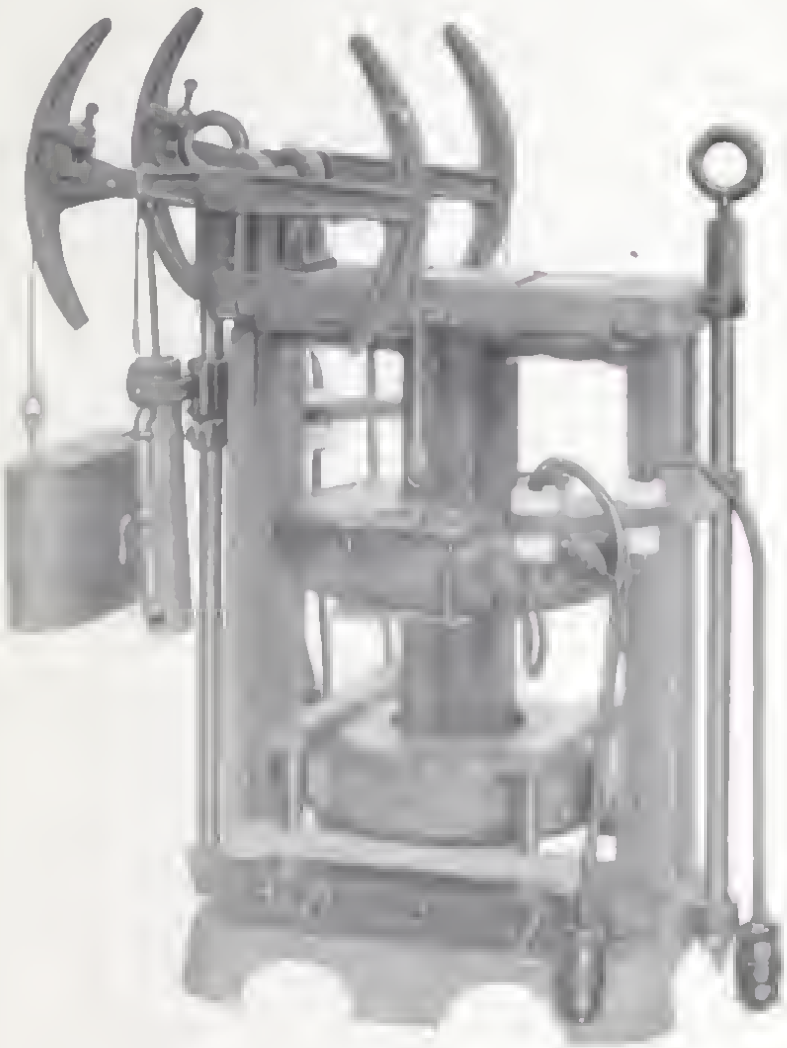
THEORY

Alternating current is generally supplied at constant potential, consequently, when lamps or other apparatus requiring constant current are used it is necessary to equip the circuit with some means of transforming from constant voltage supply to constant current. A constant series reactance will maintain approximately constant current if the circuit is highly inductive, but the power-factor will be sacrificed. In order then to maintain constant current and at the same time a high value of power-factor it is necessary to insert in the circuit a series reactance, which changes with the load in such a manner as to keep the total impedance, and consequently, the current, constant. This variable reactance is obtained in the constant current transformer by means of two coils, movable with respect to each other. In the constant current transformers made by the General Electric Company for series incandescent street lighting, one coil is stationary, while the other is suspended from a rocker arm to the other end of which weights are attached. These weights, together with the magnetic repulsion between the coils, counterbalance the weight of the secondary coil. At full load the coils should be about 2 inches apart, and as the load falls off the tendency for the current to rise, due to the decreased resistance of the secondary circuit, is offset by the separation of the coils. The separation is caused by the greater repulsion of the increased magnetic flux, due to the momentarily increased current in the secondary coil. With the coils farther apart more of the magnetic lines of force from the primary coil go out between the coils as leakage flux and the e.m.f. induced in the secondary is decreased in proportion to the fall in the secondary load, thus maintaining the current at a constant value.

The General Electric transformers are designed so that the coils will separate sufficiently to maintain constant current, even when all of the lamps are cut out of the circuit; in other words, they regulate from full load to no load maintaining constant current on the secondary within 1 per cent on either side of normal. The center of curvature of the weight sector arm is adjustable, as is also the amount of balancing weight.

TYPE RJ CONSTANT CURRENT TRANSFORME

TYPE RB CONSTANT CURRENT TRANSFORMERS



TYPE RJ CONSTANT CURRENT TRANSFORMERS

ADVANTAGES

1. Coils are of the ventilated type except on the t smallest sizes. All windings are made up of pre-treated doul cotton covered round wire.

2. Core riveted with insulated rivets, making a ve substantial construction.

3. Balancing mechanism supported on ball bearin This, together with high repulsion between coils, insures excelle regulation.

4. Balancing mechanism raised entirely out of the windo removing any possibility of the moving coil coming into conta with the end of sector in case of short circuit on line.

5. All parts are visible, open to free ventilation and ea to keep clean.

6. After transformers leave factory, no adjustment necessary.

7. A constant current transformer is a unit and is, the fore, easy to handle and occupies a minimum amount of fl space.

8. Taps are provided on all transformers but the t smallest sizes to allow the transformer to be operated at part load with full load operating characteristics.

9. Transformers are designed to have an ultimate te perature rise not to exceed 50 deg. C. by resistance based o surrounding air temperature of 25 deg. C.

10. An Instruction Book or Card written clearly a concisely on installation, operation and general maintenanc supplied with each transformer and should be carefully peru prior to handling apparatus.

TYPE RJ CONSTANT CURRENT TRANSFORMERS

DESCRIPTIVE AND GENERAL

WINDINGS

The 3 and 5 kw. sizes consist of one coil for primary an one for secondary. The 10 to 25 kw., inclusive, consist two coils for primary and two for secondary with a 1 in. vertica duct between coils for ventilating purposes. Transformers larger capacities, each consist of four coils for primary an four for secondary with a 1 in. vertical duct and ½ in. hor zontal duct between coils to give a maximum radiating surfac All of these windings are made up of pre-treated double cotto covered wire, with a double thickness of varnish-treated musli between layers. The coils are insulated with a high quality varnish-treated cotton tape and are subjected to varnish an baking treatment before completion.

CORE

The quality of laminations used in the construction of th RB transformer cores has given entire satisfaction and its us will be continued in our new design. These laminations ar rigidly held together by tubular brass rivets, insulated from th core by sleeves of cambric.

FRAME

The frame is made up of structural steel, riveted to th three legs of the core. This allows of a very substantial con struction and gives a compact and neat appearance to th outfit.

SCREEN

All transformers are equipped with a protective screenin of expanded metal, which can be easily removed for cleanin purposes if desired.

PRIMARY VOLTAGE

This line of transformers has been designed for 2300 volt primary, in view of the common use of this voltage, and the will carry full rated load and will give zero regulation on an primary voltage within 5 per cent of this figure.

SECONDARY CURRENT

The secondaries of these transformers are designed fo 6.6 and 7.5 amperes, as these appear to be the most popula currents, more especially since the introduction of the gas filled Tungsten lamps.

TAPS

Transformers of 10 to 25 kw. inclusive are provided with a partial load tap for 80 per cent of full rated load. Large capacities have taps for 70, 80 and 90 per cent of full rated load These taps are for the purpose of operating the outfit at partia load and still maintaining full load operation characteristics.

TYPE RJ CONSTANT CURRENT TRANSFORMERS

60 CYCLES, 2300 VOLTS

Cat. No.	* Kw. Output	Secondary Amp.		Cat. No.	* Kw. Output	Secondary Amp.	
171013	3	6.6		171025	30	6.6	
171014	3	7 5		171026	30	7.5	
171015	5	6.6		171027	40	6.6	
171016	5	7.5		171028	40	7.5	
171017	10	6.6		171029	50	6.6	
171018	10	7.5		171030	50	7.5	
171019	15	6.6		171031	60	6.6	
171020	15	7.5		171032	60	7.5	
171021	20	6.6		171033	70	6.6	
171022	20	7.5		171034	70	7.5	
171023	25	6.6		171035	80	6.6	
171024	25	7.5		171036	80	7.5	

* At unity power-factor load.

Transformers for 1100 volts primary and 4 or 5.5 an secondary circuits can be furnished at an increased price.

All transformers are furnished with an expanded me casing, for omission of which deduction from price is made.

The 10, 15, 20 and 25 kw. transformers have one tap 80 per cent load. The 30 kw. and above have three taps 70, 80 and 90 per cent load. All connections are good for inca descent or arc lamps or both.

They all have single circuit secondaries.

They may be operated at higher frequencies at reduc output.

TYPE RB CONSTANT CURRENT TRANSFORMERS

*25 CYCLES, 2300 VOLTS

Cat. No.	† Kw. Output	Primary Volts	Secondary Amp.	Cat. No.	† Kw. Output	Primary Volts	Secondary Amp.
151533	3	2200	6.6	151557	15	2200	6.6
151535	3	2200	7.5	151559	15	2200	7.5
151541	5	2200	6.6	151565	20	2200	6.6
151543	5	2200	7.5	151567	20	2200	7.5
151549	10	2200	6.6	151573	25	2200	6.6
151551	10	2200	7.5	151575	25	2200	7.5

* These transformers may be operated at higher frequencies at reduced output. They all have single circuit secondaries.

† At unity power-factor load.

TYPES RJ AND RB CONSTANT CURRENT TRANS FORMERS, EFFICIENCIES AND POWER-FACTOR

The following data are based on transformers with prir voltages of 2300, rated current and rated kilowatt out The rated kilowatt output is based upon an incandes lamp load of unity power-factor; i.e., actual secondary voltage which the transformer will carry with a load of u power-factor and rated secondary current.

These data should not be used for transformers of o ratings, and no guarantees should be made for such transfor without communicating with the General Office.

Kw. Sizes	Kw. Output	EFFICIENCIES				PRIMARY POWER-FACTORS			
		100 Per Cent Load	75 Per Cent Load	50 Per Cent Load	25 Per Cent Load	100 Per Cent Load	75 Per Cent Load	50 Per Cent Load	(
60 CYCLE TRANSFORMERS									
3	3.0	93.5	92.0	88.5	80.25	85.75	65.0	44.5	2
5	5.0	94.5	92.75	90.0	83.0	86.5	65.25	44.75	2
10	10.0	95.0	93.75	91.5	85.25	86.75	65.5	44.75	2
15	15.0	95.25	94.25	92.25	86.5	87.0	65.75	44.75	2
20	20.0	95.5	94.5	92.75	87.25	87.25	66.0	45.0	2
25	25.0	95.75	94.75	92.75	87.25	87.75	66.25	45.0	2
30	30.0	95.75	94.75	93.0	87.5	88 25	66.75	45.25	2
40	40.0	95.75	94.75	93.0	87.5	88 5	67.0	45.25	2
50	50.0	96.0	95.0	93.0	87.5	88.75	67.0	45.25	2
60	60.0	96.0	95.0	93.0	87.75	88.75	67.25	45.5	2
70	70.0	96.0	95.25	93.25	87.75	89.0	67.25	45.5	2
80	80 0	96.25	95.25	93.25	88 0	89.25	67.5	45.75	2
60 CYCLES OPERATED AT 125 CYCLES									
3	2.5	92.0	90.0	86.0	75.0	73.0	56.0	39.0	2
5	4.5	94.0	92.5	88.0	81.5	74.0	56.75	40.5	2
10	8.5	95.0	93.5	91.5	85 5	71.75	54.0	37.0	1
15	13.0	95.5	94.75	93.0	87.0	72.0	54.0	37.0	1
20	16.5	96 0	95.0	93.25	87.75	72.0	54.25	37.0	1
25	21.5	96.25	95.0	93.5	88.0	73.0	55.5	38.0	1
30	28.0	96 25	95.25	93.75	88.25	76.0	57.0	39.0	2
40	37.0	96.5	95.5	93.75	88.5	78 0	59.0	40.5	2
50	46.0	96.75	95.75	94.0	89.0	80.0	60.0	41.0	2
60	57.0	96.75	95.75	94.0	89.5	81.0	61.0	41.5	2
70	66.0	97.0	96.0	94.25	89.5	82.0	62.0	42.0	2
80	76 5	97.0	96 0	94.5	90.0	83.0	63.0	42.5	2
25 CYCLE TRANSFORMERS									
3	3.0	88.2	84.8	79.4	66.2	82.2	62.5	43.2	2
5	5.0	91.5	89.5	84.8	74.0	82.2	62.5	43.2	2
10	10.0	92.5	90.6	87.0	77.6	82 4	62.8	43.4	2
15	15.0	93.6	92.2	89.4	81.4	82.4	62.8	43.4	2
20	20.0	93.8	92.5	89.5	81.8	83.5	63.6	43.8	2
25	25.0	94 0	92.6	89.6	82 0	85.0	64.5	44.5	2
25 CYCLE TRANSFORMERS OPERATED AT 40 CYCLES									
3	2.5	90.0	86.2	80.5	68.2	70.2	53.8	38.2	2
5	4.5	91.0	89.0	84.5	74.2	72.0	56.0	38.4	2
10	9.0	93.5	91.4	87.4	78.2	73.8	56.2	38.6	2
15	14 25	94 2	92.5	89.6	82.2	74.0	56.5	38.8	2
20	17 75	94.4	92.6	90.0	82.6	74.0	56.5	38.8	2
25	22.5	94.8	93.4	90.0	84.0	75.5	57.5	39.5	2

* At unity power-factor load.

TYPE RJ CONSTANT CURRENT TRANSFORMERS

GENERAL DATA

Cat. No.	KW. OUTPUT 60 Cycle Unity Power-Factor	125 Cycle Unity Power-Factor	133 Cycle 90% Power-Factor	Primary Volts	Secondary Amp.	Primary Amp.	Transformer Kv-a. Input	Secondary Load Volts 60 Cycle
171013	3	2.5	1.6	2300	6.6	1.63	3.75	400
171014	3	2.5	1.6	2300	7.5	1.63	3.75	455
171015	5	4.5	2.6	2300	6.6	2.66	6.12	667
171016	5	4.5	2.6	2300	7.5	2.66	6.12	758
171017	10	8.5	5.3	2300	6.6	5.28	12.14	1334
171018	10	8.5	5.3	2300	7.5	5.28	12.14	1516
171019	15	13.0	7.7	2300	6.6	7.87	18.10	2000
171020	15	13.0	7.7	2300	7.5	7.87	18.10	2275
171021	20	16.5	10.3	2300	6.6	10.42	24.0	2670
171022	20	16.5	10.3	2300	7.5	10.42	24.0	3030
171023	25	21.5	12.5	2300	6.6	12.96	29.8	3330
171024	25	21.5	12.5	2300	7.5	12.96	29.8	3790
171025	30	28.0	21.5	2300	6.6	15.44	35.5	4000
171026	30	28.0	21.5	2300	7.5	15.44	35.5	4550
171027	40	37.0	28.5	2300	6.6	20.52	47.2	5335
171028	40	37.0	28.5	2300	7.5	20.52	47.2	6065
171029	50	46.0	36.0	2300	6.6	25.52	58.7	6670
171030	50	46.0	36.0	2300	7.5	25.52	58.7	7580
171031	60	57.0	43.0	2300	6.6	30.65	70.5	8000
171032	60	57.0	43.0	2300	7.5	30.65	70.5	9100
171033	70	66.0	49.5	2300	6.6	35.60	81.9	9340
171034	70	66.0	49.5	2300	7.5	35.60	81.9	10600
171035	80	76.5	57.0	2300	6.6	40.50	93.2	10660
171036	80	76.5	57.0	2300	7.5	40.50	93.2	12120

TYPE RB CONSTANT CURRENT TRANSFORMER
GENERAL DATA (Cont'd)

Cat. No.	* KW. OUTPUT		Prim. Volts	Sec. Amp.	Prim. Amp.	Trans-former Kv-a. Input	
	25 Cycles	40 Cycles					C
151528	3	2.5	1100	4.0	3.68	4.5	
151529	3	2.5	2200	4.0	1.84	4.5	
151530	3	2.5	1100	5.5	3.68	4.5	
151531	3	2.5	2200	5.5	1.84	4.5	
151532	3	2.5	1100	6.6	3.68	4.5	
151533	3	2.5	2200	6.6	1.84	4.5	
151534	3	2.5	1100	7.5	3.68	4.5	
151535	3	2.5	2200	7.5	1.84	4.5	
151536	5	4.5	1100	4.0	5.9	7.0	1
151537	5	4.5	2200	4.0	2.95	7.0	1
151538	5	4.5	1100	5.5	5.9	7.0	
151539	5	4.5	2200	5.5	2.95	7.0	
151540	5	4.5	1100	6.6	5.9	7.0	
151541	5	4.5	2200	6.6	2.95	7.0	
151542	5	4.5	1100	7.5	5.9	7.0	
151543	5	4.5	2200	7.5	2.95	7.0	
151544	10	9.0	1100	4.0	12.1	14.5	2
151545	10	9.0	2200	4.0	6.05	14.5	2
151546	10	9.0	1100	5.5	12.1	14.5	1
151547	10	9.0	2200	5.5	6.05	14.5	1
151548	10	9.0	1100	6.6	12.1	14.5	1
151549	10	9.0	2200	6.6	6.05	14.5	1
151550	10	9.0	1100	7.5	12.1	14.5	1
151551	10	9.0	2200	7.5	6.05	14.5	1
151552	15	14.25	1100	4.0	17.32	20.75	3
151553	15	14.25	2200	4.0	8.66	20.75	3
151554	15	14.25	1100	5.5	17.32	20.75	2
151555	15	14.25	2200	5.5	8.66	20.75	2
151556	15	14.25	1100	6.6	17.32	20.75	2
151557	15	14.25	2200	6.6	8.66	20.75	2
151558	15	14.25	1100	7.5	17.32	20.75	2
151559	15	14.25	2200	7.5	8.66	20.75	2
151560	20	17.75	1100	4.0	22.84	27.0	5
151561	20	17.75	2200	4.0	11.42	27.0	5
151562	20	17.75	1100	5.5	22.84	27.0	3
151563	20	17.75	2200	5.5	11.42	27.0	3
151564	20	17.75	1100	6.6	22.84	27.0	3
151565	20	17.75	2200	6.6	11.42	27.0	3
151566	20	17.75	1100	7.5	22.84	27.0	2
151567	20	17.75	2200	7.5	11.42	27.0	2
151568	25	22.50	1100	4.0	28.4	33.5	6
151569	25	22.50	2200	4.0	14.2	33.5	6
151570	25	22.50	1100	5.5	28.4	33.5	4
151571	25	22.50	2200	5.5	14.2	33.5	4
151572	25	22.50	1100	6 6	28.4	33.5	3
151573	25	22.50	2200	6.6	14.2	33.5	3
151574	25	22.50	1100	7.5	28.4	33.5	3
151575	25	22.50	2200	7.5	14.2	33.5	3

* At unity power-factor load.

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS—DIMENSIONS

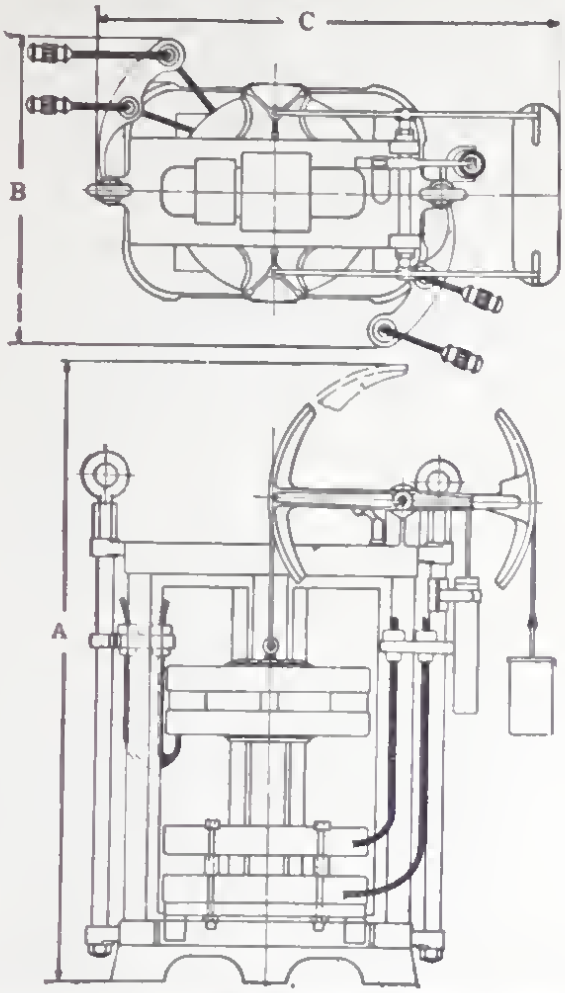


Fig. 3

Kw.	DIMENSIONS IN INCHES			APPROX. WT. IN LB.	
	A	B	C	Net	Ship.
RJ Transformers, 60 Cycles					
3	31½	13½	21	280	400
5	36	16¾	23½	350	550
10	40¼	19½	27	580	750
15	44½	22	30	800	1000
20	48¾	23¼	34	1000	1250
25	52¾	24½	37½	1250	1600
30	57¼	27½	42	1500	2000
40	61½	28½	44½	1825	2550
50	65¾	30	46¾	2250	2950
60	70	31¾	49	2600	3400
70	75⅜	33¼	51	2925	3700
80	77¾	35	51¾	3200	3975
RB Transformers, 25 Cycles					
3	39 5/16	18	25⅞	385	570
5	42⅝	18	28⅛	525	755
10	47½	21½	31 5/16	880	1085
15	50½	21	35	1100	1355
20	52 11/16	24½	37 9/16	1402	1695
25	54 15/16	24½	38 13/16	1620	1960

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

DIAGRAMS OF CONNECTIONS

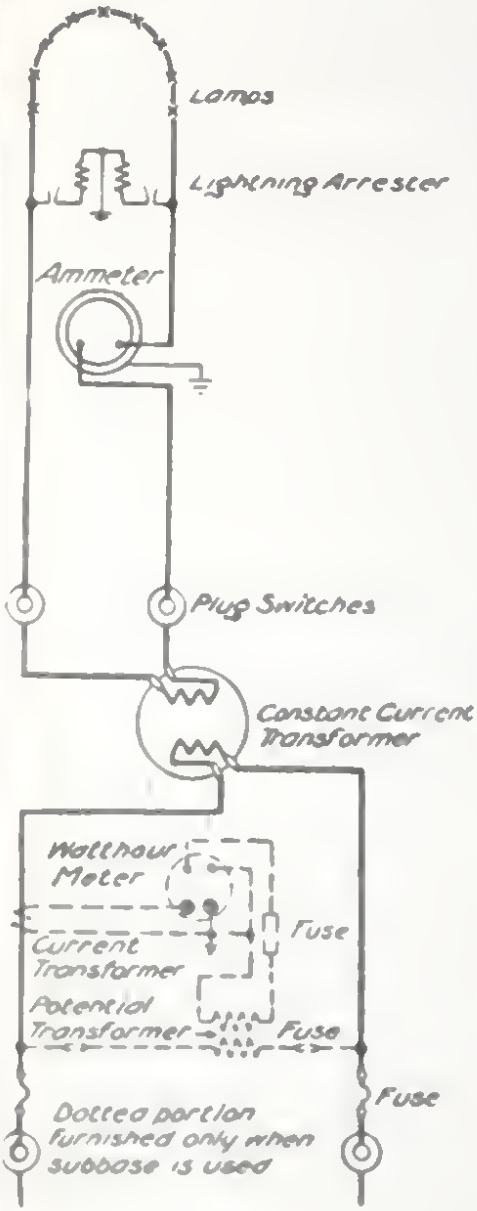


Fig. 4

ONE ARC OR INCANDESCENT LAMP CIRCUIT FROM ONE TRANSFORMER

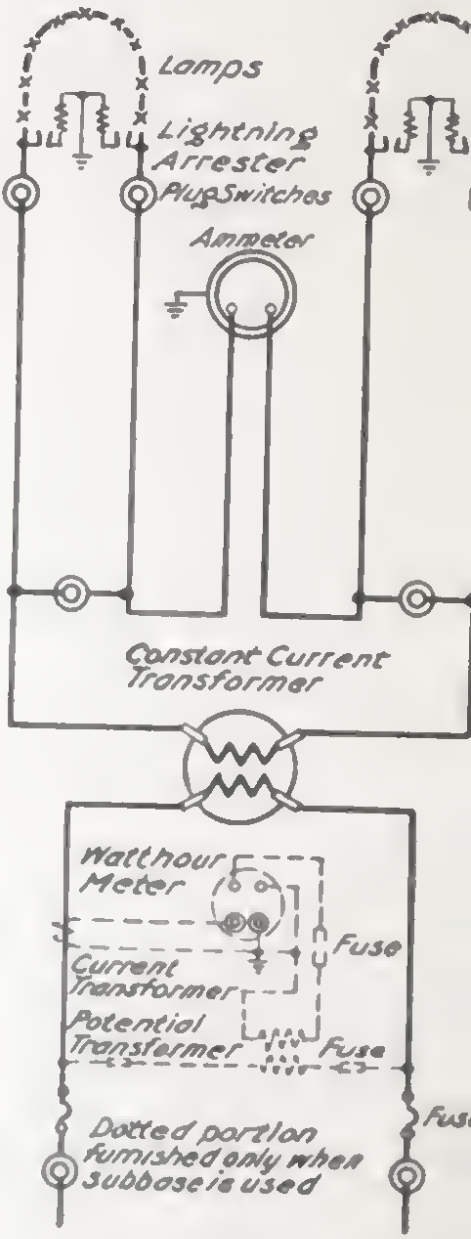


Fig. 5

TWO ARC OR INCANDESCENT LAMP CIRCUITS FROM ONE TRANSFORMER

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

TRANSFORMER AND CIRCUIT CONNECTIONS

STANDARD TRANSFORMER AND PANEL

Fig. 6

SINGLE COIL TRANSFORMER WITH SINGLE CIRCUIT

STANDARD TRANSFORMER, STANDARD PANEL

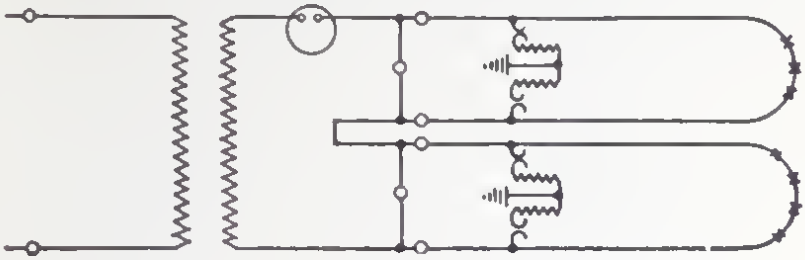


Fig. 7

SINGLE COIL TRANSFORMER WITH TWO CIRCUITS OPERATED SINGLY OR IN SERIES

SPECIAL TRANSFORMER, STANDARD PANEL

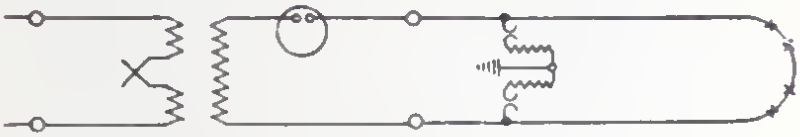


Fig. 8

SERIES MULTIPLE PRIMARY SINGLE CIRCUIT SECONDARY

SPECIAL TRANSFORMER, STANDARD PANEL

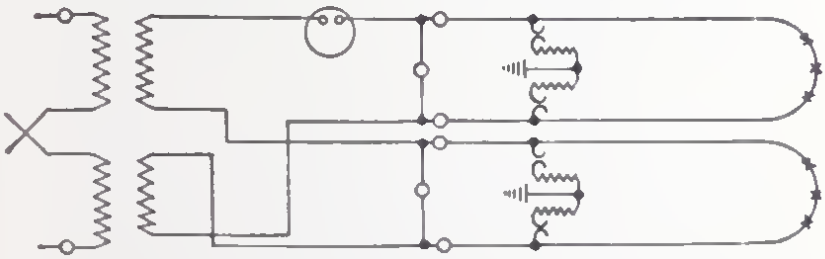


Fig. 9

SERIES MULTIPLE PRIMARY, MULTI-CIRCUIT SECONDARY

Figs. 6 and 7 show the standard connections for the complete line of constant current transformers for series alternating current lighting circuits.

Figs. 8 and 9 show the manner in which the transformer is wound when it is necessary to operate from both 1100 and 2200 volts primary. The secondary arrangement in Fig. 9 is not recommended as that in Fig. 7 accomplishes the same result with standard devices.

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

TRANSFORMER AND CIRCUIT CONNECTIONS (Con

SPECIAL TRANSFORMER, SPECIAL PANEL

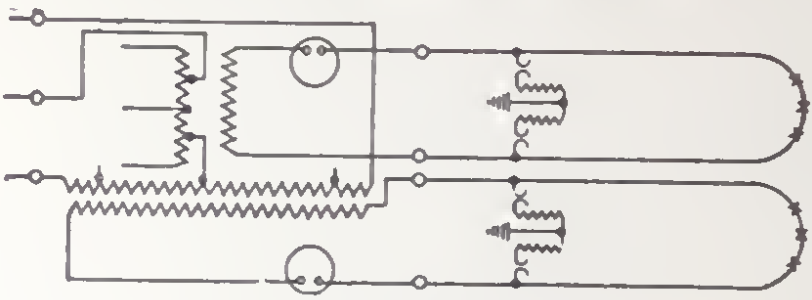


Fig. 10

THREE-PHASE SCOTT CONNECTED PRIMARY TWO INDEPENDENT SECONDARY CIRCUITS SINGLE COILS. (TWO SEPARATE TRANSFORMERS)

SPECIAL TRANSFORMER, SPECIAL PANEL

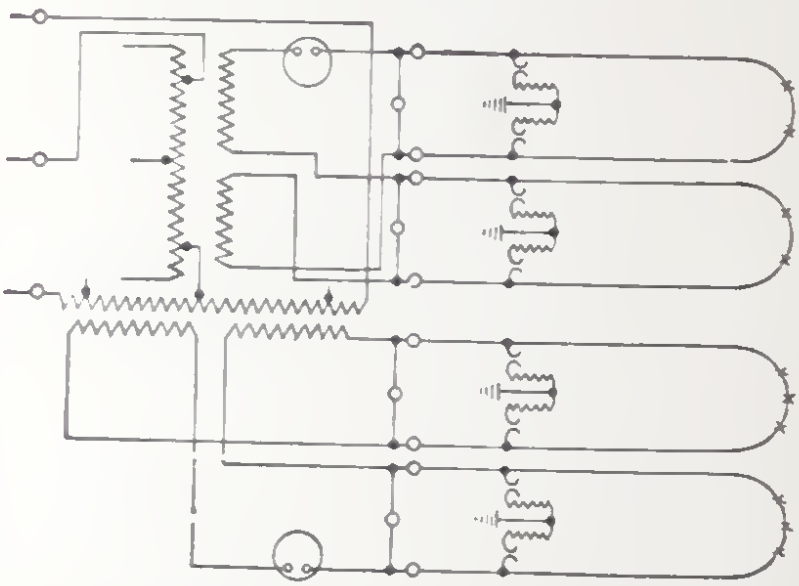


Fig. 11

THREE-PHASE SCOTT CONNECTED PRIMARY, TWO INDEPENDENT SECONDARY CIRCUITS, EACH SECONDARY CIRCUIT HAVING TWO PARTS IN SERIES ALTERNATELY WITH THE TWO COILS (TWO SEPARATE TRANSFORMERS)

Figs. 10 and 11 show the connections for operating fro three-phase primary circuits.

When special transformers and panels are desired a qu tation must be obtained from the General Office.

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

PANELS

These panels are designed for the control of one single secondary coil constant current transformer and either one or two lamp circuits, or for two or three single secondary coil transformers and one lamp circuit per transformer. The lamp circuits may be either arc or incandescent. All panels are rated on the basis of transformer kilowatt output at unity power-factor. They are designed for installation near the transformers they are to control and are not suitable for assembly in a switchboard.

Fig. 12
(Front View)

Fig. 13
(Rear View)

SINGLE CIRCUIT ARC OR INCANDESCENT PANEL WITH WATTHOUR METER SUBBASE (FOR ONE TRANSFORMER)

INSTRUMENT EQUIPMENT

The ammeters are connected directly in series with the secondary circuits, and on all panels on which the secondary voltage exceeds 2300 volts, the ammeter is provided with an insulating cover and with insulating bushings for the studs where they extend through the panel.

The ammeters have movable markers which may be set at the requisite current value so that any deviation of the current may be readily detected.

WATTHOUR METER EQUIPMENT

Standard subbases equipped with a watthour meter and necessary current and potential transformers are listed for all panels except those for two or three transformers. The watthour

TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

WATTHOUR METER EQUIPMENT (Cont'd)

meters are for the purpose of recording the total input of to the constant current transformer, and Central Managers will appreciate the advantages of this equ as providing a means of accurately determining the energy for the lighting system.

SWITCH EQUIPMENT

The primary switches consist of General Electric Con standard plug switch and tubular expulsion fuse combin single unit, the fuses being of such capacity as to rupt circuit only under emergency conditions equivalent to circuit on the transformer.

Fig. 14

Open circuiting secondary plug s are provided on all panels for the p of disconnecting the line from the ary of the transformer when test ground or open circuit.

Short circuiting secondary plug s are included in the equipment of for one transformer and two lamp only and permit the operation of on circuit when the other is shut down.

VOLTAGE

If so specified in the order, any will be furnished for 1150 volts, the c being in the capacity of the primary and when the watthour meter sub used, in the potential transformer p and the capacity of the current transf

FREQUENCY

Unless otherwise ordered all app will be calibrated for 60 cycles. panels will be furnished for any frec from 25 to 140 cycles without add charge, but when a watthour mete base is used on frequencies less than 60 cycles the pric be increased.

MATERIAL, FRAMEWORK AND FINISH

The panels are Blue Vermont Marble, 1½ in. thick ⅜ in. bevel, and are mounted on a self-supporting fram of 1 in. pipe 64 in. high.

Instruments and meters have the General Electric pany's standard dull black finish while the supporting f work is black japanned.

LIGHTNING ARRESTERS

Lightning arresters are recommended for each lamp c They are not included with these panels and must be or separately.

PANELS FOR TYPES RJ AND RB TRANSFORMERS * 2300 VOLTS

Cat. No.	Transformer † Kw. Output	Secondary Amperes	No. of Transformers Controlled	Ship. Wt in Lb.
PANELS FOR THE CONTROL OF ONE, TWO OR THREE SINGLE SECONDARY TRANSFORMERS WITH ONE LAMP CIRCUIT PER TRANSFORMER				
154586	3	6.6 and 7.5	1	300
154622	3	6.6 and 7.5	2	375
154630	3	6.6 and 7.5	3	475
154587	5	6.6 and 7.5	1	300
154623	5	6.6 and 7.5	2	375
154631	5	6.6 and 7.5	3	475
154589	10	6.6 and 7.5	1	300
154625	10	6.6 and 7.5	2	375
154633	10	6.6 and 7.5	3	475
154591	15	6.6 and 7.5	1	300
154627	15	6.6 and 7.5	2	375
154635	15	6.6 and 7.5	3	475
154592	20	6.6 and 7.5	1	350
154628	20	6.6 and 7.5	2	425
154636	20	6.6 and 7.5	3	550
154593	25	6.6 and 7.5	1	350
154629	25	6.6 and 7.5	2	425
154637	25	6.6 and 7.5	3	550
154594	30	6.6 and 7.5	1	325
154595	40	6.6 and 7.5	1	325
154596	50	6.6 and 7.5	1	325
154597	60	6.6 and 7.5	1	325
154598	70	6.6 and 7.5	1	325
154599	80	6.6 and 7.5	1	325
PANELS FOR THE CONTROL OF ONE SINGLE SECONDARY TRANSFORMER WITH TWO LAMP CIRCUITS				
154604	3	6.6 and 7.5	1	350
154605	5	6.6 and 7.5	1	350
154607	10	6.6 and 7.5	1	350
154609	15	6.6 and 7.5	1	350
154610	20	6.6 and 7.5	1	350
154611	25	6.6 and 7.5	1	350
154612	30	6.6 and 7.5	1	325
154613	40	6.6 and 7.5	1	325
154614	50	6.6 and 7.5	1	325
154615	60	6.6 and 7.5	1	325
154616	70	6.6 and 7.5	1	325
154617	80	6.6 and 7.5	1	325

* The panels listed above are designed for 2300 volts, 25 to 140 cycles and will be so furnished unless otherwise ordered. With slight modifications the panels may be used for 1100 volts. No additional charge is made for 1100 volt panels.

† At unity power-factor load.

PANELS FOR TYPE RJ CONSTANT CURREN TRANSFORMERS

* SUBBASE WITH WATTHOUR METER

†Transformer Kw. Output	Primary Volts	Ampere Capacity Current Transformer	SUBBASE FOR ONE CIRCUIT PANEL			SUBBASE FO CIRCUIT PA	
			Cat. No.	Ship. Wt. in Lb.		Cat. No.	Ship Wt. in Lb
3	2300	5	152108	225		152114	250
5	2300	5	152108	225		152114	250
10	2300	10	152109	225		152115	250
15	2300	10	152109	225		152115	250
20	2300	15	152110	225		152116	325
25	2300	15	152110	225		152116	325
30	2300	20	152111	225		152117	325
40	2300	20	152111	225		152117	325
50	2300	30	152112	325		152118	250
60	2300	30	152112	325		152118	250
70	2300	40	152113	325		152119	250
80	2300	40	152113	325		152119	250

* Designed for 60 cycles only but can be furnished for other frequen special price.

† At unity power-factor load.

PANELS FOR TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

EQUIPMENT

For One Transformer and One or Two Lamp Circuits

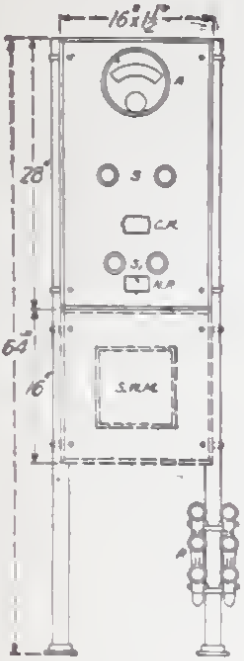


Fig. 15

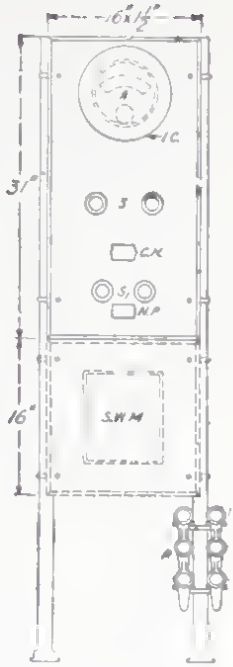


Fig. 16

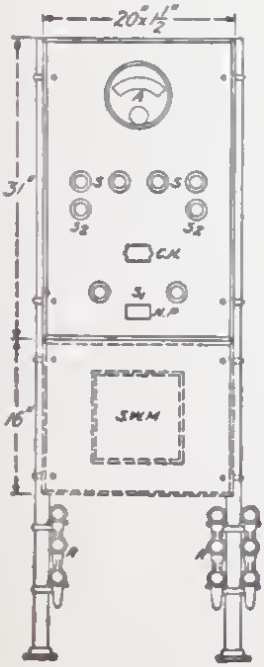


Fig. 17

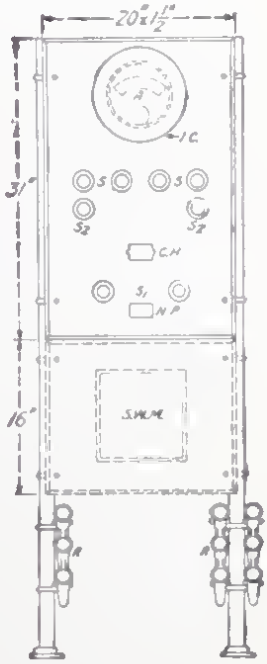


Fig. 18

PANELS FOR TYPES RJ AND RB CONSTANT CURR TRANSFORMERS

(Each Cat. No. includes only such of the following shown on the Figure to which the Cat. No. applies.)

MAIN PANEL

A = 10 amp. R-6 ammeter with movable marker. ampere for 10 amp. flame arc lamp circuits.)

I.C. = Insulating cover for ammeter.

S = *Two* or *four* S-P. open circuiting secondary plug swi with plugs.

S1 = *Two* S-P.S-T. 2500 volt primary plug switches plugs and fuses.

S2 = *Two* S-P. short circuiting secondary plug swi with plugs.

C.H. = Card holder.

N.P. = Name plate.

R = *Two* or *three* plug racks each for three plugs.

WATTHOUR METER SUBBASE

S.W.M. = 5 amp. 110 volt IS-2 single-phase watt meter with metal cover.

One current transformer.

One 50 watt 2200/110 volt 60/125 cycle potential t former and fuses.

AMPERE CAPACITIES				CAT. NOS.					
Transformer Kw. Output at Unity Power-Factor	Lamp Circuit	Primary Fuses (Main Panel)	Current Transformer (Watthour Meters Subbase)	Panels for One Lamp Circuit			Panels for T Lamp Circu		
				Fig. No. (See Page 25)	Main Panel	Watthour Meter Subbase	Fig. No. (See Page 25)	Main Panel	
3	6.6, 7.5	2.5	5	15	154586	152108	17	154604	15
5	6.6, 7.5	4.0	5	15	154587	152108	17	154605	15
10	6.6, 7.5	6.0	10	15	154589	152109	17	154607	15
15	6.6, 7.5	10.0	10	15	154591	152109	17	154609	15
20	6.6, 7.5	12.0	15	16	154592	152110	18	154610	15
25	6.6, 7.5	15.0	15	16	154593	152110	18	154611	15
30	6.6, 7.5	20.0	20	16	154594	152111	18	154612	15
40	6.6, 7.5	20.0	20	16	154595	152111	18	154613	15
50	6.6, 7.5	25.0	30	16	154596	152112	18	154614	15
60	6.6, 7.5	30.0	30	16	154597	152112	18	154615	15
70	6.6, 7.5	40.0	40	16	154598	152113	18	154616	15
80	6.6, 7.5	40.0	40	16	154599	152113	18	154617	15

PANELS FOR TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

EQUIPMENT (Cont'd)

For Two or Three Transformers and One Lamp Circuit per Transformer

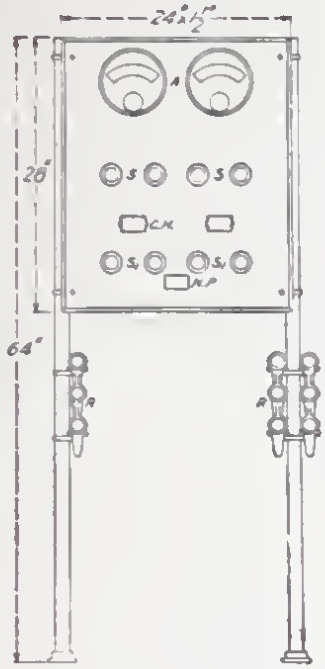


Fig. 19

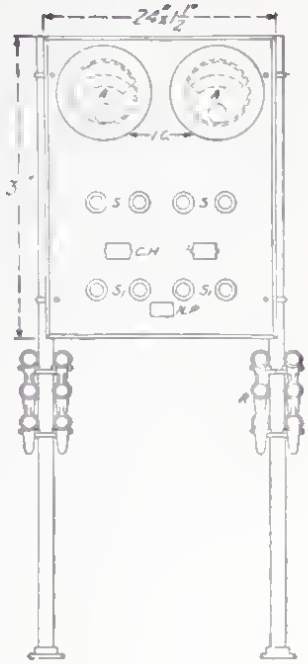


Fig. 20

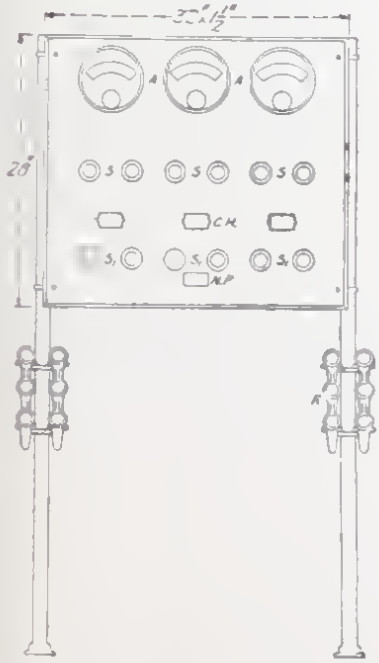


Fig. 21

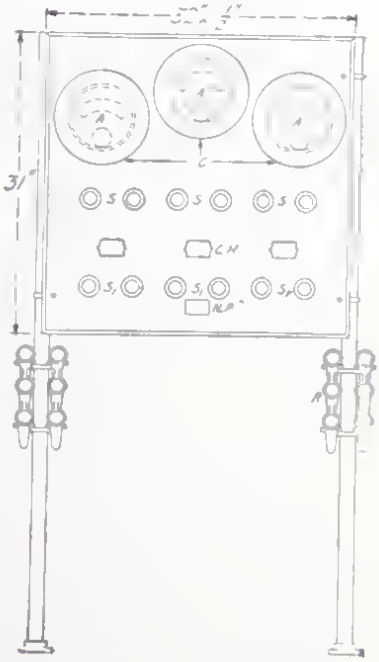


Fig. 22

PANELS FOR TYPES RJ AND RB CONSTANT CUR
TRANSFORMERS

(Each Cat. No. includes only such of the following shown on the Figure to which the Cat. No. applies.)

A = *Two* or *three* 10 amp. R-6 ammeter with movable m

I.C. = *Two* or *three* insulating covers for ammeters.

S = *Four* or *six* S-P. open circuiting secondary plug sw with plugs.

S1 = *Four* or *six* S-P.S-T. 2500 volt primary plug sw with plugs and fuses.

C.H. = *Two* or *three* card holders.

N.P. = Name plate.

R = *Three* or *four* plug racks each for three plugs.

DATA

Transformer Kw. Output at Unity Power-Factor	AMPERE CAPACITY		PANELS FOR TWO TRANSFORMERS		PANELS FOR TRANSFORM	
	Lamp Circuit	Primary Fuses	Fig. No. (See Page 27)	Cat. No.	Fig. No. (See Page 27)	C N
3	6.6, 7.5	2.5	19	154622	21	154
5	6.6, 7.5	4.0	19	154623	21	154
10	6.6, 7.5	6.0	19	154625	21	154
15	6.6, 7.5	10.0	19	154627	21	154
20	6.6, 7.5	12.0	20	154628	22	154
25	6.6, 7.5	15.0	20	154629	22	154

HORN TYPE LIGHTNING ARRESTERS FOR TYPES RJ AND RB CONSTANT CURRENT TRANSFORMERS

The proper selection and installation of the lightning rrester equipment is an important feature of any serics incan- escent installation. As many Central Stations suffer enormous sses each year resulting from lightning, we recommend for the rotection of the series circuits our horn type arresters, with ries resistances. Lighting circuits are usually confined to city mits, consequently the principal sources of trouble are not ıe high frequency disturbances but low frequency surges set ɔ by sudden opening of the loaded circuits. These disturb- ıces are specially severe when circuits are accidentally grounded ue to contact of the wires where they pass through the tops trees or become crossed with other circuits.

The horn type arrester is most satisfactory for this service the surge set up by the sudden opening of the circuit is dis- pated by the arrester before the arc is interrupted. The arc ually lasts for several cycles as the operation of the arrester pends upon the lengthening of the arc, limited by the series istance. The resistance aids the horns in extinguishing the c, limits the size of the arc and prevents short circuits occur- ng during the period of discharge.

It is recommended that these arresters be installed in the ation on each outgoing line and that particular attention be ven to connections, especially those to ground.

The most satisfactory method of making the ground con- ctions is to drive a number of 1 in. iron pipes into the earth a depth of 6 or 8 feet at several points near the station, nnecting all of these pipes together by means of copper wire copper strips. A quantity of salt should be placed around ch pipe on the surface and the ground thoroughly moistened ith water.

If the lightning disturbances are of frequent occurrence is advisable to occasionally examine the ground connections see that they are in proper condition, as the failure of any ghtning arrester is in many instances due to poor ground nnections.

LIGHTNING ARRESTERS FOR A-C. SERIES CIR
HORN TYPE

Kw. Rating of Transformers (Secondary Amperes 6.6 and 7.5)	FOR STATION (INDOOR) USE		FOR POLE (OU USE	
	Double-Pole Cat. No.	Approx. Ship. Wt. in Lb.	Single-Pole Cat. No.	A Sh
3	47563	30	144117	
5	47563		144117	
10	47563		144117	
15	47558	40	144117	
20	47559	100	144119	
25	47560	90	144121	
30	47560		144121	
40	47560		144121	
50	47561	130	144123	
60	47561		144123	
70	78744	180	144123	
80	78744		144123	

TYPE SA REGULATORS AND TRANSFORMERS

TYPE SA REGULATORS AND TRANSFORMERS

DESCRIPTIVE AND GENERAL

TRANSFORMERS

The design of transformers used in connection with SA egulators is in general the same as that of our standard multiple ransformers. The tanks and method of mounting in tanks, iowever, are different and transformers are therefore designated is Type A, Form P9, which signifies that the transformer)roper is mounted in a sheet steel tank, and suspended by bolts rom the cover.

This construction possesses the following advantages:

1. The bottom of the tank and space surrounding core and 'oils is free for rapid circulation of oil.

2. Transformer proper can be completed to the last detail, ind thoroughly inspected before lowering into tank.

3. Easy removal for inspection and repair without drawing)il from tank. 3 and 5 kw. transformers are built in air-:ooled casc.

FRAME OR TANK

The 3 and 5 kv-a. transformers are mounted on cast iron rames, the punchings being held in place between these two :astings with a slate top bolted to the top frame. The frames are similar in appearance to our standard alternating current :ompensarc frames. They are air-cooled, so that the absence of)il enables them to be installed in places where no special)recautions need to be taken on account of the underwriters' 'ules.

Sizes larger than 5 kv-a. are mounted in tanks made of ieavy sheet steel, with all joints gas welded, and are absolutely)il tight. There are no soldered joints, as experience has demon-strated that these are dangerous, especially in case of fire. Heat)pens them, allowing oil to run out, adding fuel to the flames.

A vent is provided at bottom of tank for drawing, and inother is located near the top to indicate when coils are sub-merged.

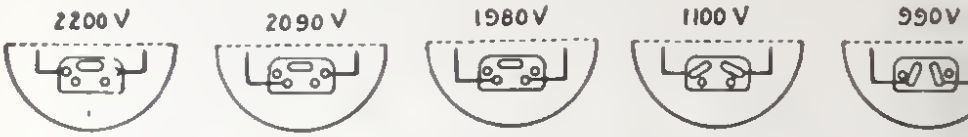
PRIMARY WINDINGS

The standard primary windings for sizes above 5 kv-a. are arranged for series multiple connections on 1100 and 2200 volt circuits. Taps are brought out in each half of the winding, so that on the 2200 volt circuit corrections can be made for reduced primary voltage for either 5 or 10 per cent and on the 1100 volt circuit corrections can be made for 10 per cent reduction in voltage. In case the secondary is not quite high enough, use

TYPE SA REGULATORS AND TRANSFORMERS

PRIMARY WINDINGS (Cont'd)

can be made of these taps in order to increase the second voltage proportionately. All of these various combinations shown in cuts herewith.



3 and 5 kw. transformers are connected for one volt and without taps in primary. This is done because the

Fig. 23

TYPE ND AIR-COOLED TRANSFORMER, 60 CYCLES, 3 AND 5 KV-A., CAPACITY 2200 VOLTS

cooled casing mounted on a terminal block will be inconvenie and with the excess voltages provided for we do not consid that taps in the primary are necessary.

TAPS

Standard secondary windings have taps brought o between coils, and connected to plug receptacles on a marb slab mounted on transformer tanks. (Other manufacture dead end their taps, sometimes inside the case.) By means plugs the impressed voltage on the circuit can be readily adjust to correspond with the number of lamps operating on the circu maintaining the power-factor and efficiency at a maximum.

Taps to give voltage other than standard should be di couraged, as they compel us to tap into the coils. This mak insulation difficult, and produces unequal expansion in the tw parts of the coil, with consequent strains which are apt to cau trouble.

TYPE SA REGULATORS AND TRANSFORMERS

Fig. 24

INTERIOR OF TYPE A FORM P9 TRANSFORMER LIFTED OUT OF TANK

TYPE SA REGULATORS AND TRANSFORMER

TYPE SA REGULATORS

The regulator consists of an impedance coil surrou the middle branch of an ш shaped magnetic core to whic attached by a system of levers. The weight of the core co balances the pull of the coil in such a way that the core ar move proportional to the choking effect required on the c

The complete regulator consists of a coil, core, lever stand.

Fig. 25
TYPE SA CURRENT REGULATOR

COIL

The reactive coil is form wound, impregnated with a m tureproof compound by a vacuum treatment, taped with a grade insulating tape and finally varnished with the very grade of insulating varnish. The finished coil is clamped betw brass clamps and a wooden terminal block, the clamps form the guides between the coil and core. The individual turns of

TYPE SA REGULATORS AND TRANSFORMERS

COIL (Cont d)

coil being molded into one solid mass by the compound, and provision being made for ample ventilation, the regulator runs at a very low temperature. The coils being form wound and taped, can be very easily replaced in case of accident. In the larger coils where higher voltages are used, the coils are built up in sections, thus dividing the potential strain over the windings, and in the case of a burnout, making it necessary to replace only the damaged section.

CORE

The core is made up of laminated iron punchings riveted and bolted together into a solid core. The iron used is chosen for its high magnetic characteristics so that the core losses are reduced as much as possible. The core is carefully japanned so that the regulator makes a neat and pleasing appearance.

LEVERS AND STAND

The weight of the coil and core is carried by the levers over a fulcrum support on hardened knife edges and pins. The fulcrum support is carried by an **A** shaped cast iron stand which provides good ventilation and leaves the regulator open so that it can easily be kept clean.

OPERATION

On open circuit, the coil and core hang apart, the weight of the core on its lever arm overbalancing the coil on the opposite end of the same lever. When the circuit is closed, the current flowing through the line (this being a series circuit, the same current flows through the coil of the regulator) attracts the coil and core. The coil moving down over the iron core adds the reactance of the regulator to the resistance of the incandescent lamps until such a point is reached that the attractive force of the coil and core balance, at which point the normal current is flowing on the line. Should the current decrease slightly, the coil moves up reducing the reactance added to the circuit and thus increasing the current. Should the current increase slightly, the coil moves down over the core increasing the reactance added to the circuit and bringing the current back to normal value.

STARTING DEVICE

When used with arc lamps, the regulator was provided with a starting switch and reactance so arranged that the regulator was brought to a position of maximum reactance with the arc lamp line short circuited. This short circuit being opened, the regulator moved to its normal position quietly without allowing the lamps to chatter. With the MAZDA lamps this cannot be

TYPE SA REGULATORS AND TRANSFORMERS

STARTING DEVICE (Cont'd)

done so readily as the lamp line has too high a resistance short circuited on starting. To prevent an undue rush of cu on closing the circuit (this applying only to loads less tha full load), the regulator has been provided with a sta stirrup on sizes up to 7½ kw. and a starting handle for above this.

The starting stirrup for the small sizes consists of a mounted on set screws which hang on the stand under the These set screws can be adjusted so that the core is held up the coil slightly lower than the position it would maintain the load it is to carry. The necessity of this device is appa when it is considered that when standing with the coil and apart, the regulator has very little reactance, and the MA lamps forming the remainder of the circuit, have some lower resistance than when carrying their normal current was soon found that if the regulator was connected dir to a circuit of lamps less than the full load rating of the regu there would be an instantaneous rush of current consider higher in value than the normal current for which the la were made. This would damage the lamps, the damage b more serious, the less the number of lamps in circuit. Wh full load of lamps is carried, this starting stirrup is unneces so that the set screws can be backed off, leaving the sti hanging clear of the core of the regulator. As sent out, the sti is adjusted for the regulator to carry two-thirds of its no load without allowing an undue rush of current through circuit, as we have found that the greater number of t regulators are not loaded up to full load when first put service.

The starting handle is shown in Fig. 25 and consists handle attached across the frame and which can be pushed d and latched previous to starting the circuit and absolu prevents any sudden rush of current.

AMPERE RATINGS

Regulators are built for currents of 4, 5.5, 6.6 and amperes which cover practically all of the MAZDA lamps in It has been found that the line loss for the series incandesc system is a much greater proportion of the total losses tha the case of the series arc system, the reason being that watts used per lamp are very much less in the incandesc lamp than in the arc lamp while the length of line and size the wire are about the same.

For this reason we have made an allowance for this loss by arranging for a slightly greater transformer capac than is called for in the kilowatt rating.

TYPE SA REGULATORS AND TRANSFORMERS

REGULATOR TEMPERATURE GUARANTEES

The regulators are designed to operate at full load with full load voltage on an indefinite run, with a temperature rise not greater than 50 deg. C. above a room temperature of 25 deg. C. From the very nature of the case, the losses and necessarily the temperature rise increases quite rapidly with a decrease in load. Where the regulators are supplied by our standard series incandescent transformer, the taps on the transformer allow the total voltage to be adjusted to the demand of the circuit so that the regulator can be operated at its full load position on partial loads. These regulators are designed for 100 per cent regulation, normal voltage; that is, the lamps may be turned off one at a time from full load until all the lamps are off and the regulator short circuited, without an undue increase in current. The regulator will maintain the current within 0.1 of an ampere of normal current on any position of load. A temperature rise not to exceed 55 deg. C. above a room temperature of 25 deg. C., at the end of 2 hours' run on short circuit is guaranteed, it being expected of course, that the regulator will only be called on for this kind of service in an emergency as a Central Station is not likely to run its street lighting equipment with all the lamps turned off. For partial loads, we can guarantee the regulator with normal full load voltage without standard step-up transformers to carry any load down to one-half its rated full load capacity with a temperature rise not exceeding 55 deg. C. above a room temperature of 25 deg. C., at the end of 8 hours' run.

Restated, these temperature guarantees are as follows: On rated voltage and normal frequency; full load indefinitely—50 deg. C. rise; short circuit, 2 hours 55 deg. C. rise; ½ load, 8 hours, 55 deg. C. rise; above a room temperature of 25 deg. C. Considering normal operative conditions outside, it will be found that these temperature guarantees will cover practically all operating conditions.

USE OF REGULATORS WITHOUT TRANSFORMERS

We do not recommend the use of these SA regulators directly on the circuit without an insulating transformer and in every case where it is necessary for commercial reasons to furnish same without the transformer, customer must assume all risk of burnouts and permission must be secured from the Home Office before the quotation is made.

SUMMARY

The SA regulator and transformer has many advantages for series incandescent street lighting use.

1. Being in two units, an accident to either the regulator or transformer does not affect the other.

TYPE SA REGULATORS AND TRANSFORMER

SUMMARY (Cont'd)

2. The coil of the regulator is very easily replaced i of a burnout.

3. There being no moving coil for the secondary transformer, the insulation is not called upon to stan mechanical strain due to the movement of the coils. Th of the regulator can be easily insulated to withstand any s that may come on it without in any way affecting its fre of movement.

4. The coil and core being balanced against each respond very quickly to changes in the circuit.

5. The regulating mechanism being in full view wi open stand, is easily kept clean and its operation can be re observed at all times.

6. The adjustment of the regulator is a very si matter, the current adjustment being affected by smal screw in the lever arm.

TYPE SA CONSTANT CURRENT REGULATORS AND TRANSFORMERS

1100 AND 2200 VOLT PRIMARIES

* Kw. Output	CAT. NO. SA Regulator 60 Cycles	CAT. NO. SA Regulator 125 to 140 Cycles	CAT. NO. Transformer 60 to 140 Cycles	Regulator Secondary Amps.	Transformer Secondary Volts
3	190236	190240	190244	4.0	890
	190237	190241	190245	5.5	648
	190238	190242	190246	6.6	540
	190239	190243	190247	7.5	475
5	190248	190252	190256	4.0	1385
	190249	190253	190257	5.5	1010
	190250	190254	190258	6.6	840
	190251	190255	190259	7.5	740
7½	190955	190959	190963	4.0	2065
	190956	190960	190964	5.5	1500
	190957	190961	190965	6.6	1250
	190958	190962	190966	7.5	1100
10	190260	190264	190268	4.0	2740
	190261	190265	190269	5.5	1990
	190262	190266	190270	6.6	1660
	190263	190267	190271	7.5	1460
15	190272	190276	190280	4.0	4125
	190273	190277	190281	5.5	3000
	190274	190278	190282	6.6	2500
	190275	190279	190283	7.5	2200
20	190284	190288	190292	4.0	5475
	190285	190289	190293	5.5	3980
	190286	190290	190294	6.6	3320
	190287	190291	190295	7.5	2925
25	190296	190299	190302	5.5	4980
	190297	190300	190303	6.6	4150
	190298	190301	190304	7.5	3650
30	190305	190308	190311	5.5	5970
	190306	190309	190312	6.6	4975
	190307	190310	190313	7.5	4380

* Lamp capacity in kilowatts at unity power-factor load with an allowance for line loss.

TYPE SA REGULATORS AND TRANSFORMERS

EFFICIENCIES AND POWER-FACTOR

4 TO 7.5 AMPERES—60 TO 140 CYCLES

* Kw. Output	Load	EFFICIENCIES			Pow Fac Sys
		Transformer	Regulator	Combined Regulator and Transformer	
3	Full	95.8	96.5	92.5	94
	⅔	95.3	93.2	88.8	93
	⅓	92.7	90.0	83.4	65
5	Full	96.8	97.4	94.3	94
	⅔	96.4	93.5	90.4	93
	⅓	94.4	90.0	84.9	65.
7½	Full	97.0	97.7	94.8	94.
	⅔	96.6	93.5	90.2	92.
	⅓	94.6	91.2	85.3	79.
10	Full	97.2	98.0	95.3	93.
	⅔	96.8	93.6	90.6	92.
	⅓	94.9	91.5	86.8	74.
15	Full	97.5	98.3	95.7	93.
	⅔	97.3	95.6	93.0	92.
	⅓	95.9	92.5	88.8	74.
20	Full	97.8	98.5	96.3	93.
	¾	97.6	96.4	94.2	92.
	½	97.1	94.8	92.1	91.
	¼	95.2	92.0	87.7	74.
25	Full	97.9	98.6	96.5	93.
	¾	97.7	96.5	94.3	92.
	½	97.5	94.8	92.5	91.
	¼	95.5	92.0	88.0	74.
30	Full	97.9	98.6	96.5	93.
	¾	97.8	96.5	94.4	92.
	½	97.3	95.0	92.5	91.
	¼	95.5	92.5	88.4	74.

DIMENSIONS AND WEIGHTS

* Kw.	REGULATOR			TRANSFORMER			
	Floor Space in In.	Height in In.	Ship. Wt.	Kv-a.	Floor Space in In.	Heigbt in In.	Gal-lons Oil
3	13½ by 13½	20	160	3	14¾ by 11	21	None
5	16 by 20	30	280	5	14¾ by 11	23	None
7½	16 by 20	30	300	7½	17 by 17	24	14
10	21 by 20	30	365	10	17 by 17	33	16
15	21 by 20	30	450	15	21 by 21	31¼	20
20	26 by 20	30	610	20	21 by 21	37¼	25
25	26 by 20	30	690	25	21 by 21	41¼	30
30	21 by 27	43	725	30	25 by 25	43½	40

* Lamp capacity in kilowatts at unity power-factor load, with an allowa
for line loss.

TYPE SA REGULATORS AND TRANSFORMERS

GENERAL DATA

60 CYCLES

Cat. No. of Regulator	* Kw. Output	Secondary Amperes	PRIMARY AMP. 1100 Volts Primary	PRIMARY AMP. 2200 Volts Primary	Transformer Kv-a. Input	Secondary Load Volts
190236	3	4.0	3.2	1.6	3.56	750
190237	3	5.5	3.2	1.6	3.56	545
190238	3	6.6	3.2	1.6	3.56	455
190239	3	7.5	3.2	1.6	3.56	400
190248	5	4.0	5.2	2.6	5.73	1250
190249	5	5.5	5.2	2.6	5.73	910
190250	5	6.6	5.2	2.6	5.73	760
190251	5	7.5	5.2	2.6	5.73	670
190955	7½	4.0	7.8	3.9	8.50	1875
190956	7½	5.5	7.8	3.9	8.50	1365
190957	7½	6.6	7.8	3.9	8.50	1140
190958	7½	7.5	7.8	3.9	8.50	1000
190260	10	4.0	10.2	5.1	16.9	3750
190261	10	5.5	10.2	5.1	16.9	2730
190262	10	6.6	10.2	5.1	16.9	2280
190263	10	7.5	10.2	5.1	16.9	2010
190272	15	4.0	15.4	7.7	16.9	3750
190273	15	5.5	15.4	7.7	16.9	2730
190274	15	6.6	15.4	7.7	16.9	2280
190275	15	7.5	15.4	7.7	16.9	2010
190284	20	4.0	20.4	10.2	22.4	5000
190285	20	5.5	20.4	10.2	22.4	3640
190286	20	6.6	20.4	10.2	22.4	3040
190287	20	7.5	20.4	10.2	22.4	2680
190296	25	5.5	25.4	12.7	28.0	4550
190297	25	6.6	25.4	12.7	28.0	3800
190298	25	7.5	25.4	12.7	28.0	3350
190305	30	5.5	30.4	15.2	33.5	5460
190306	30	6.6	30.4	15.2	33.5	4560
190307	30	7.5	30.4	15.2	33.5	4020

* Lamp capacity in kilowatts at unity power-factor load with an allowance for line loss.

TYPE SA REGULATORS AND TRANSFORMERS

PANELS

These panels are designed for the control of one, two three series circuits, each with its individual transformer a regulator; or two or three circuits supplied from one transforr and one regulator. Panels are rated on the basis of transforr kilowatt output at unity power-factor. No panels are listed c trolling outfits consisting of one or more regulators without tra formers. If such a layout is required, request must be taken with the Home Office. All panels are designed for individ installation and are not suitable for mounting together i continuous switchboard.

INSTRUMENTS

The ammeters are connected directly in series with secondary circuits, and on all panels on which the seconda voltage exceeds 2300 volts, the ammeter is provided with insulating cover and with insulating bushings for the stu where they extend through the panel.

The ammeters have movable markers which may be at the requisite current value so that any deviation of the curr may be readily detected.

WATTHOUR METER WITH SUBBASE

Watthour meters are furnished, where required, mount on a suitable subbase and with the necessary current a potential transformers. The watthour meter is connected the primary of the power transformer to record the total inp of energy to the system.

SWITCH EQUIPMENT

Plug switches are used on all of these panels. Enclos fuses are used in the primary circuit, these fuses being select approximately 25 per cent above the normal operating capaci Secondary switches are furnished so that the line can be entir disconnected for testing or other purposes.

VOLTAGE

These panels can be used on either 1100- or 2200-v circuits. Primary fuses and the watthour meter potent transformers being furnished on each order to suit the pow transformer used.

FREQUENCY

Unless otherwise ordered, apparatus will be calibrat for 60 cycles. Equipment, however, will be furnished for a frequency from 25 to 125 cycles without additional charge.

MATERIAL, FRAMEWORK AND FINISH

All panels are of Blue Vermont marble, 1¼ in. thi without bevelled edges, and are mounted on a 1 in. pipe fran 64 in. high, supported from the floor.

Instruments and meters have dull black finish while t supporting framework is black japanned.

TYPE SA REGULATORS AND TRANSFORMERS

PANELS

Cat. No.	No. of Regulators	No. of Transformers	No. of Circuits	* Max Trans. Secondary Voltage	Fig. No.	Size of Panels in In.	Ship. Wt
190967	1	1	1	2300	30	28 by 16	300
190968	2	2	2	2300	31	28 by 24	375
190969	3	3	3	2300	32	28 by 36	500
190970	1	1	1	6600	30	28 by 16	325
190971	2	2	2	6600	31	28 by 24	425
190972	3	3	3	6600	32	28 by 36	550
190973	1	1	2	2300	33	36 by 16	350
190974	1	1	3	2300	34	36 by 20	425
190975	1	1	2	6600	35	40 by 16	375
190976	1	1	3	6600	36	40 by 20	450

* See Page 41.

WATTHOUR METER SUBBASES

Cat. No.	No. of Watthour Meters	Fig. No.	Size of Subbase in In.	Ship. Wt
190977	1	30, 31, 32	12 by 16	175
190978	1	34, 35	12 by 20	185
190979	2	31	12 by 24	250
190980	3	32	12 by 36	325

TYPE SA REGULATORS AND TRANSFORMERS
PANEL EQUIPMENT

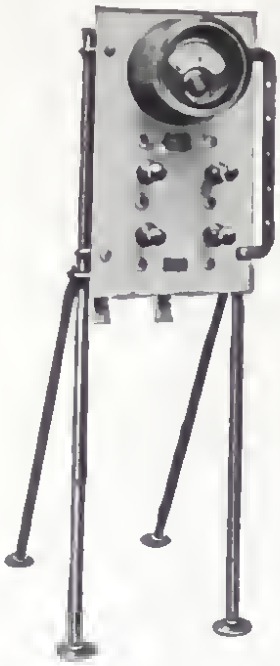


Fig. 26
FRONT VIEW OF SINGLE CIRCUIT PANEL

Fig. 27
BACK VIEW OF SINGLE CIRCUIT PANEL

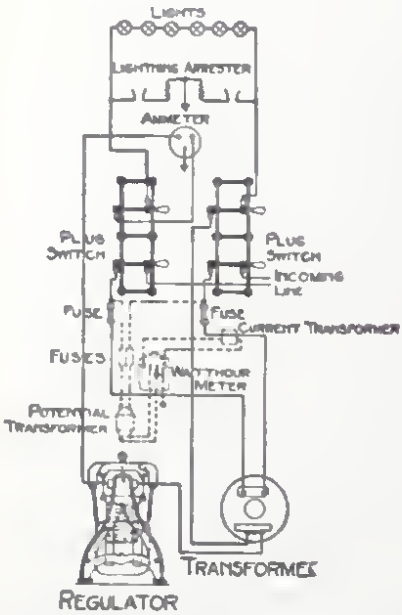


Fig. 28
WIRING DIAGRAM OF ONE REGULATOR, ONE TRANSFORMER AND ONE CIRCUIT

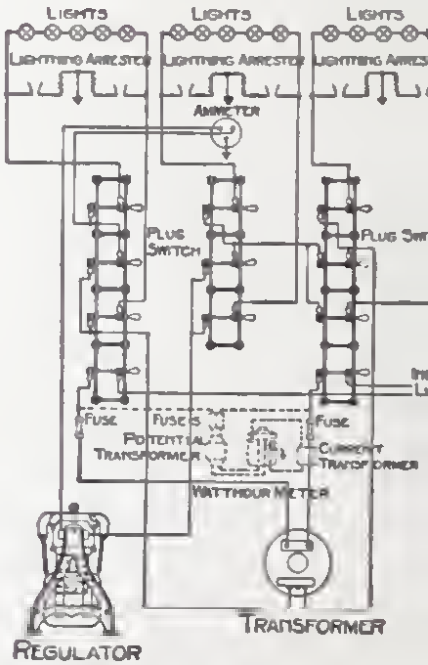


Fig. 29
WIRING DIAGRAM FOR ONE REGULAT ONE TRANSFORMER AND THREE CIRCUITS

TYPE SA REGULATORS AND TRANSFORMERS

PANEL EQUIPMENT (Cont'd)

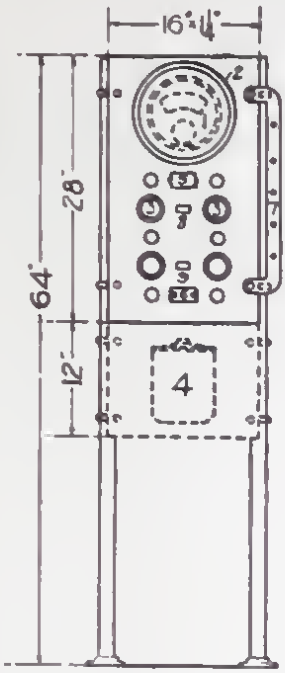


Fig. 30

SWITCHBOARD FOR ONE REGULATOR, ONE TRANSFORMER AND ONE CIRCUIT

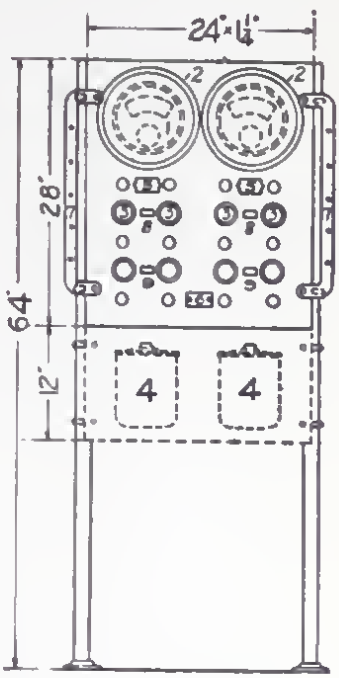


Fig. 31

SWITCHBOARD FOR TWO REGULATORS, TWO TRANSFORMERS AND TWO CIRCUITS

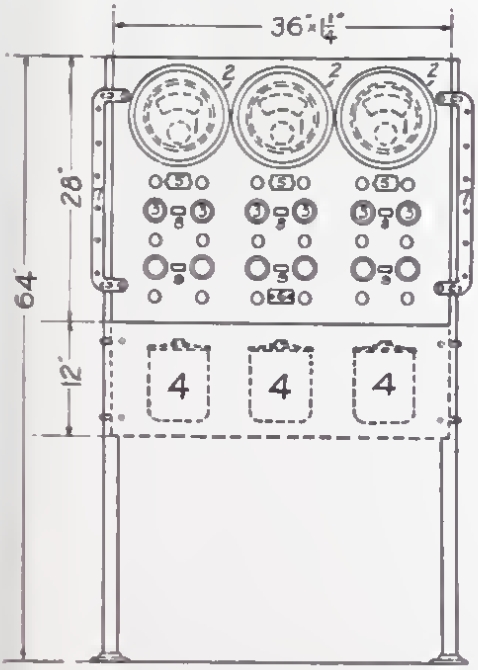


Fig. 32

SWITCHBOARD FOR THREE REGULATORS, THREE TRANSFORMERS AND THREE CIRCUITS

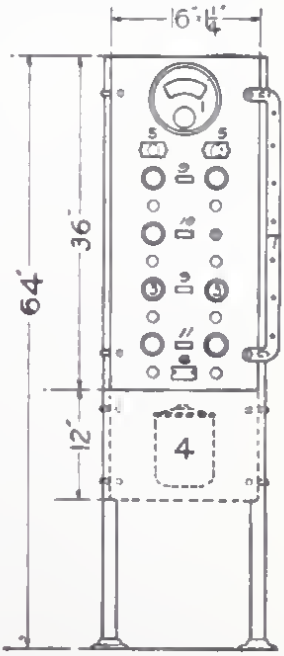


Fig. 33

SWITCHBOARD FOR ONE REGULATOR, ONE TRANSFORMER AND TWO CIRCUITS. (2300 VOLTS AND BELOW)

TYPE SA REGULATORS AND TRANSFORMERS
EQUIPMENT (Cont'd)

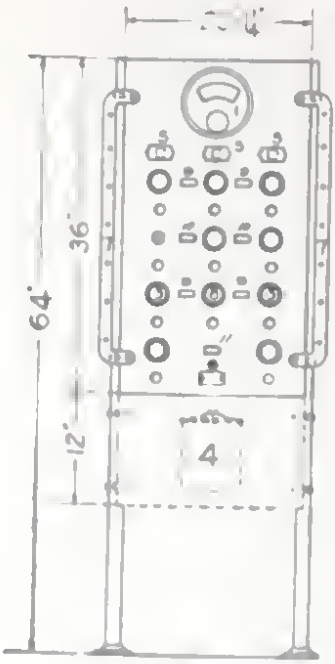


Fig. 34

SWITCHBOARD FOR ONE REGULATOR, ONE TRANSFORMER AND THREE CIRCUITS (2300 VOLTS AND BELOW)

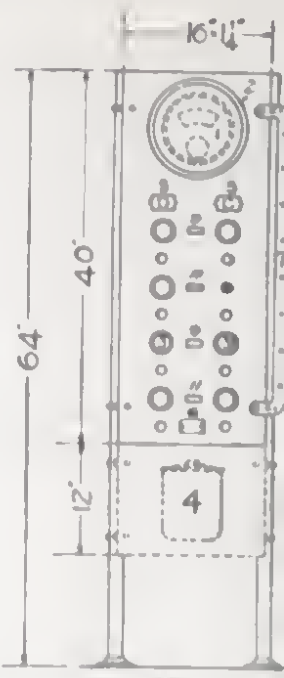


Fig. 35

SWITCHBOARD FOR ONE TRANSFORMER, ONE REGULATOR AND TWO CIRCUITS (ABOVE 2300 VOLTS)

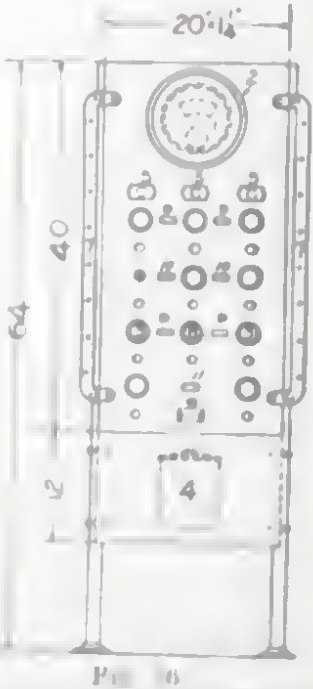


Fig. 36

SWITCHBOARD FOR ONE REGULATOR, ONE TRANSFORMER AND THREE CIRCUITS (ABOVE 2300 VOLTS)

TYPE SA REGULATORS AND TRANSFORMERS

HORN TYPE LIGHTNING ARRESTERS

STATION ARRESTERS		POLE ARRESTERS	
Cat. No. of Arrester	Approx. Ship. Wt. in Lb.	Cat. No. of Arrester	Approx. Ship. Wt. in Lb.
47558	35	144117	45
47559	100	144119	45
47560	150	144121	50
47561	130	144123	60
47563	30		

DATA

Kw. Output	Secondary Amperes	* FOR USE WITH SINGLE CIRCUIT PANELS	
		FOR STATION (INDOOR) USE	FOR POLE (OUTDOOR) USE
		Double-Pole Cat. No.	Single-Pole Cat. No.
3	4 to 7.5	47563	144117
5	4 to 7.5	47563	144117
7½	4 to 5.5	47558	144117
7½	6.6 to 7.5	47563	144117
10	4 and 5.5	47558	144117
10	6.6 and 7.5	47563	144117
15	4	47560	144119
15	5.5	47559	144119
15	6.6 and 7.5	47558	144117
20	4 and 5.5	47560	144121
20	6.6 and 7.5	47559	144119
25	4	47561	144123
25	5.5, 6.6 and 7.5	47560	144121
30	5.5, 6.6 and 7.5	47560	144121

* With two circuit panels two double-pole or four single-pole arresters should be used.

TYPE PD STATIONARY COIL TRANSFORMERS

TYPE PD STATIONARY COIL TRANSFORMERS
THEORY

The current regulation of any transformer between full load and short circuit depends on the impedance. If the transformer has an impedance of 4 per cent at full load current, then the short circuit current will be approximately 25 times the full load current. By increasing the impedance at full load, the current at short circuit is reduced; therefore, if we provide a fixed reactance of the proper value, we may obtain any current regulation required.

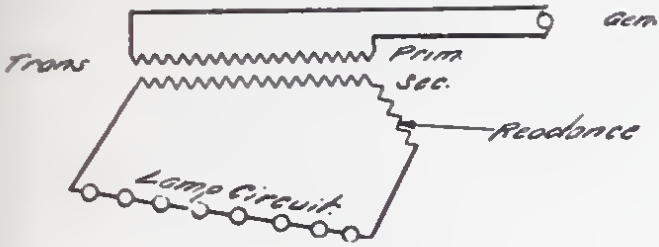


Fig. 37

Fig. 37 shows a diagram of connections in which the part of the winding marked "Reactance" is the fixed reactance previously referred to. This reactance may be a separately wound coil, but in our present design is inherent in the transformer.

When a separately wound reactance coil is used, it is necessary to have an open magnetic circuit in the core. This air gap should be inside of the coils to prevent the flux across the gap from passing to the case, clamps or other iron parts. The air gaps must necessarily be adjustable, as it is impracticable to calculate the length of the gap and then build to the calculated dimensions. This could, of course, be done but it would make a very expensive construction. The most satisfactory way is to adjust the gap in test and clamp the core, then compound the core and coils. With this type there are two separate parts which enlarge the physical size of the transformer, necessitating a large tank and a large quantity of oil.

Where the reactance is inherent in the transformer, the open magnetic circuit and two separate parts in one tank are disposed of. However, if we attempt to obtain all of the reactance necessary by displacement of the high- and low-voltage windings, we again have an excessive physical size. Also, trouble would probably result, due to the flux passing through the clamps, tank, etc.

TYPE PD STATIONARY COIL TRANSFORMERS

DESCRIPTIVE

The stationary coil constant current transformer l
been designed for controlling certain classes of series str
lighting where it is desirable to mount the transformer on
pole and operate it with a time switch. As this transforn
has no moving parts, it is well adapted to fill this condition.

Fig. 38

STATIONARY COIL CONSTANT CURRENT TRANSFORMER

is similar in general appearance to the Type H Form K consta
potential transformer. In operating the high efficiency MAZD
lamps it will allow a smaller variation between full load ar
short circuit than any device on the market except the movab
coil constant current transformer.

A considerable field exists where a transformer of this kin
can be used. This field can be divided into two parts as follow

1. Where Lighting Companies run transmission lin
through small villages where no lighting is done at the preser
time, this stationary coil transformer will make it possible t
install 10 to 30 incandescent lamps without necessitating a
attendant to watch the operation of the transformer or lamp
the transformer being turned on and off by means of a tim
switch.

At the present time, these villages are not lighted for th
reason that the cost of running special wires from the neares

Central Station is so high as to make it prohibitive and it is entirely out of the question to put in a Central Station and employ an attendant to care for the small number of lamps that would be used in these small villages.

Fig.
INSTALLATION OF STATIONARY COIL CONSTANT CURRENT TRANSFORMER

2. The transformer will be used extensively in city and suburban lighting where it does not seem desirable to use high-voltage series circuits.

TYPE PD STATIONARY COIL TRANSFORMERS

Briefly, the field for which this constant current transform is particularly adapted lies along high potential transmiss lines, in small villages, and with lighting plants where first c is the determining factor.

This transformer is oil-cooled and is mounted in a cast ir tank which is weatherproof, being provided with a gasket benea the cover which prevents the entrance of dust and moistu The cover is securely clamped down by eyebolts which serve al for lifting the transformer. To simplify installations the t primary and secondary leads are brought out of the tank. T

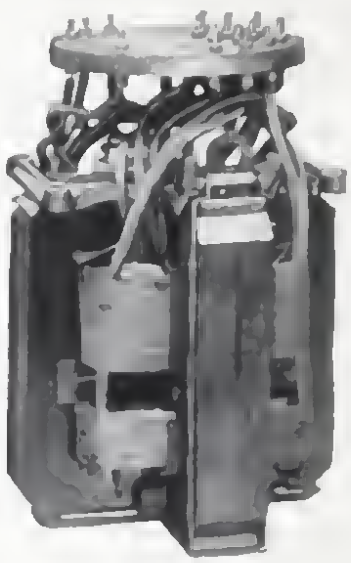


Fig. 40

oils have ample oil ducts which insure a low and uniform tem perature throughout the windings. The temperature rise i guaranteed not to exceed 50 deg. C. above 25 deg. C. Th core and coils are subjected to the well-known vacuum dryin and compound filling process leaving the transformer in a soli moistureproof and oilproof unit, which is securely bolted in th tank.

The transformer is so designed that it will not be injure when subjected to swinging or dead grounds in any part of th secondary circuit.

It is also designed so as to have an open circuit voltag which will positively puncture the film cutout when lamp burns out.

The stationary coil transformer is desirable because of the fact that it is complete in itself and has no external reactance or choke coils, as it is free from moving parts, and as it require no more attention than the ordinary lighting transformer.

TYPE PD STATIONARY COIL TRANSFORMERS

60 CYCLES, 2300 VOLTS

*Cat. No.	†Kw. Output	Primary Volts	‡Secondary Amps.	Secondary Load Volts
155013	1.0	2300	6.6	152
155014	2.0	2300	6.6	303
155015	3.0	2300	6.6	455
155016	5.0	2300	6.6	758
155535	7.5	2300	6.6	1135
155536	10.0	2300	6.6	1515

* Transformers have taps for 2200 and 2400 volt primary circuits.
† Kw. output at unity power-factor load.
‡ See Page 60.

Transformers for any primary voltage below 3300 volts and any secondary current below 7.5 amperes can be furnished without increase in price.

If panels are desired use those listed on Page 23.

LIGHTNING ARRESTERS

Circuit on which Transformer is Operated	GRADED SHUNT RESISTANCE MULTIGAP ARRESTERS		COMPRESSION CHAMBER MULTIGAP ARRESTERS	
	Cat. No.	Approx. Ship. Wt. in Lb.	Cat. No.	Approx. Ship. Wt. in Lb.
FOR PRIMARIES				
2300 volt, three- and single-phase, non-grounded, or quarter-phase, four-wire	149757	25	79218	15
4100 volt, three-phase, grounded neutal	149757	25	79219	17
Cat. No. of Transformer	**FOR SECONDARIES**			
155013	¶3413	6	146187	1
155014	149744	20	79216	9
155015	149744	20	79216	9
155016	149744	20	79217	10
155535	149744	20	79217	10
155536	149747	25	79218	15

¶Not graded shunt resistance arrester, single gap in metal case.

All arresters listed above are for pole installation.
Primaries and secondaries each require two arresters.

EFFICIENCIES AND POWER-FACTORS

The following data are based on transformers with prim voltage of 2300 volts.

The kilowatt output of transformers is based on ac secondary load voltage which transformers will carry wit load of unity power-factor. No allowance is made for line l

These data should not be used for transformers of ot ratings, and no guarantees should be made for such transforn without communicating with the General Office.

PER CENT LAMPS OUT	CONNECTIONS (See Fig. 42)	*EFFICIENCY						PRIMA POWE FACTO
		1 Kw.	2 Kw.	3 Kw.	5 Kw.	7.5 Kw.	10 Kw.	All siz
0	Full winding	91.3	92.7	93.5	94.0	94.7	95.0	50.5
10	Full winding	90.9	92.3	93.1	93.7	94.5	94.8	44.6
	Tap B	91.1	92.6	93.3	93.8	94.6	94.9	50.0
19	Tap B	90.6	92.1	93.0	93.6	94.3	94.7	44.3
	Tap C	90.9	92.4	93.2	93.7	94.4	94.8	50.3
27	Tap C	90.0	91.7	92.8	93.2	94.0	94.6	43.0
	Tap D	90.3	92.0	93.0	93.4	94.2	94.7	50.1
35	Tap D	89.3	91.3	92.2	92.7	93.6	94.2	44.2
	Tap E	89.7	91.6	92.4	92.9	93.8	94.4	50.1
43	Tap E	88.5	90.6	91.6	92.2	93.1	93.8	43.4
	Tap F	88.8	91.0	91.8	92.4	93.4	94.0	50.1
50	Tap F	87.7	90.2	91.0	91.7	92.7	93.4	43.2
	Tap G	88 9	90.4	91.2	91.5	91.9	94.0	50 0

*Efficiencies are based on the input-output method.

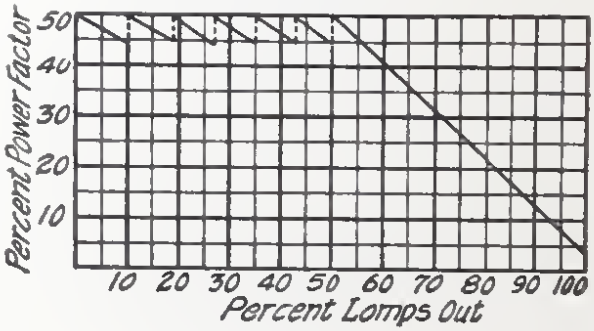


Fig. 41

GENERAL DATA

Cat. No.	Kw. Output	Primary Volts	Secondary Amperes	Primary Amperes	Trans. Kv-a. Input	Second Loac Volt
155013	1.0	2300	6.6	0.95	2.18	15
155014	2.0	2300	6.6	1.88	4.32	30
155015	3.0	2300	6.6	2.79	6.42	46
155016	5.0	2300	6.6	4.64	10.65	77
155535	7.5	2300	6.6	6.92	15.90	115
155536	10.0	2300	6.6	9.18	21.10	154

TYPE PD STATIONARY COIL TRANSFORMERS

CURRENT REGULATION

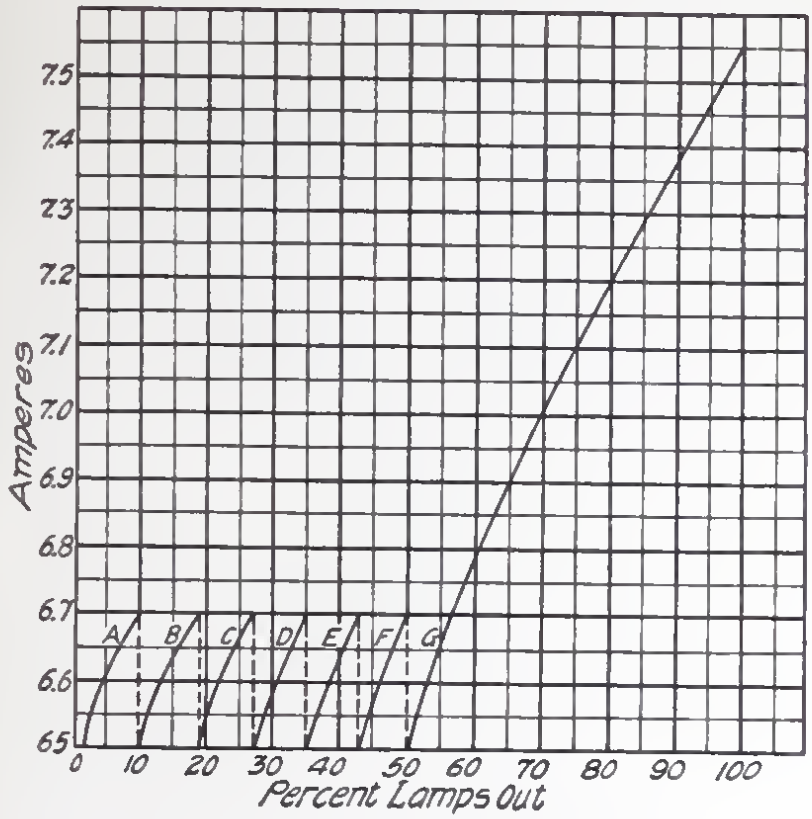


Fig. 42

2300 Volts, 60 Cycles

See Fig. 42	Per Cent in Rated Kw.	CONNECTIONS (SEE FIGS. 43 AND 44)		
		Primary Lines on	Secondary Lines on	Connect
A	90 to 100	9–11	8–13	1–18, 17–15
B	81 to 90	9–11	7–14	1–20, 18–15
C	73 to 81	9–11	6– 1	
D	65 to 73	9–11	5–18	1–15, 16–17
E	57 to 65	9–11	4–19	1–13, 14–17
F	50 to 57	9–11	3–20	1–13, 15–18
G	0 to 50	9–11	2–20	1–13, 16–18

Primary voltage 2200, primary leads on 9–10.
Primary voltage 2300, primary leads on 9–11.
Primary voltage 2400, primary leads on 9–12.

TYPE PD STATIONARY COIL TRANSFORMERS

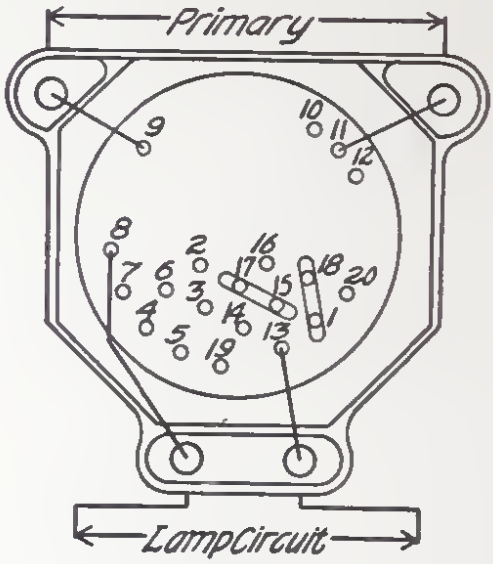


Fig. 43

DIAGRAM OF TERMINAL BOARD AS SEEN WHEN COVER IS REMOVED

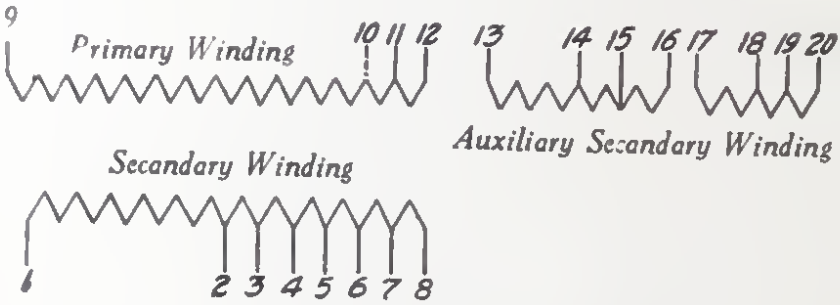


Fig. 44

DEVELOPED WINDINGS OF TRANSFORMERS

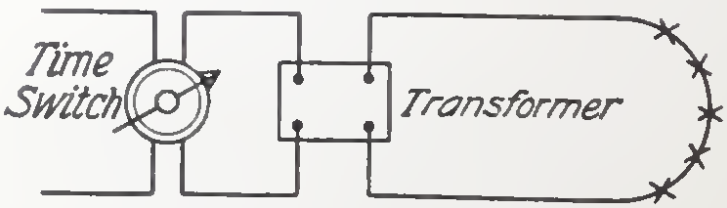


Fig. 45

TRANSFORMER AND CIRCUIT CONNECTIONS

TYPE PD STATIONARY COIL TRANSFORMERS

DIMENSIONS

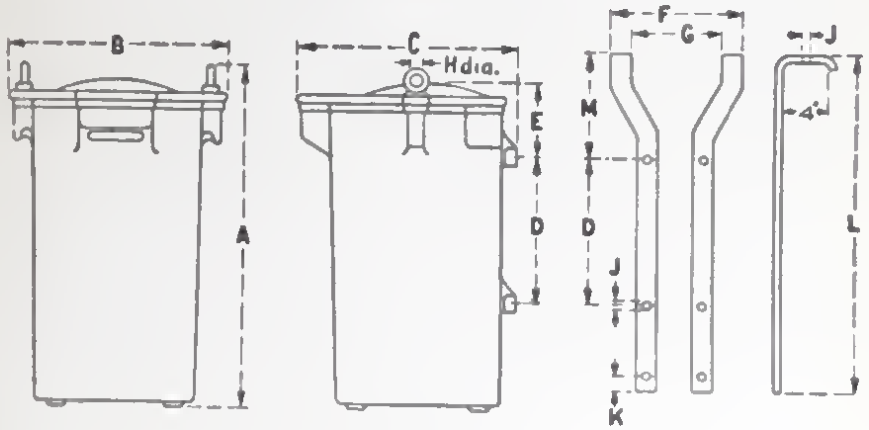


Fig. 46

DIMENSIONS IN INCHES (FIG 46)

Kw. Output	Tank Symbol	Transformer Box and Suspension Hooks											
		A	B	C	D	E	F	G	H	J	K	L	M
1.0	CP-015	21 5/8	17 3/4	17	10 1/16	4 1/4	12 3/8	8 3/8	7/8	5/8	2 1/2	29	8 3/4
2.0	CP-015	21 5/8	17 3/4	17	10 1/16	4 1/4	12 3/8	8 3/8	7/8	5/8	2 1/2	29	8 3/8
3.0	CP-017	26	18 1/4	18 1/8	12 3/8	5 3/8	12	8	7/8	3/4	2 1/2	31 1/2	8
5.0	CP-021	31 7/8	22 1/2	22 1/8	15	9 1/4	18	14	1 1/16	3/4	2 1/2	46 3/4	16
7.5	CP-023	36 5/8	22 1/16	23	15	9 1/4	18	14	1 1/16				
10.0	CP-025	41 1/2	24	24 1/2	24	9 1/2	21 3/4	16 3/4	1 1/16	3/4	2 1/2	61 3/8	16 1/4

OIL AND WEIGHTS

Kw. Output	OIL		WT. IN LB.	
	Quarts Required	Ship Wt. in Lb.	Net (Including Oil)	Ship. (Without Oil)
1.0	16	35	250	255
2.0	21	48	300	315
3.0	32	73	410	425
5.0	68	153	715	715
7.5	88	199	885	875
10.0	116	262	1050	1010

TYPE SL SERIES TRANSFORMERS

TYPE SL SERIES TRANSFORMERS

FOR OPERATING SERIES INCANDESCENT LAMPS AT LOW-VOLTAGE ON 60 CYCLE SERIES ARC OR INCANDESCENT CIRCUITS

Certain classes of lighting require lower potential than that obtainable from series arc or incandescent circuits, and to provide for this lighting companies are often compelled to run multiple circuits from the Central Station at a considerable expense.

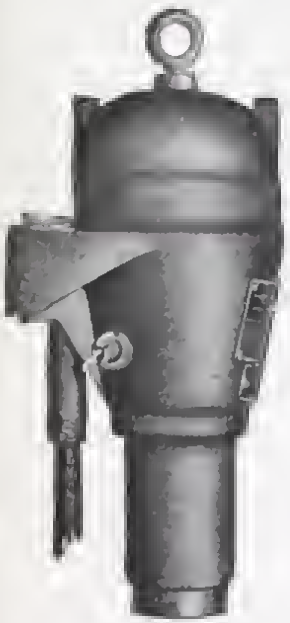


Fig. 47

60 CYCLE, 0.04 KW., 7½ AMPERES PRIMARY, 3½ AMPERES SECONDARY, FORM WA (SUBWAY TYPE) SERIES TRANSFORMER

Fig. 48

60 CYCLE, ½ KW., 6.6 AMPERES PRIMARY, 6.6 AMPERES SECONDARY, FORM A SERIES TRANSFORMER

By using a Type SL (series lighting) series transformer a low-voltage circuit may be taken directly from the series circuits when required, thus obviating a large item of expense and providing a very flexible system of distribution.

Some of the places where these transformers can be used to advantage are given below:

1. Isolated side streets or alleys where it is desired to install series incandescent lamps and where the only available circuit is a series arc circuit.

TYPE SL SERIES TRANSFORMERS

2. In places where a series system is desirable and potential is impracticable, as, for example, where it is desi place the line upon telephone poles, or where customer a few small units in a building and multiple circuits ar available.

3. On bridges where it is necessary to eliminate high pote

4. For underground circuits leading to ornamental p

5. Lighting of fire alarm boxes, police boxes or letter This system has already been installed with great success i of the largest and most enterprising cities in the country.

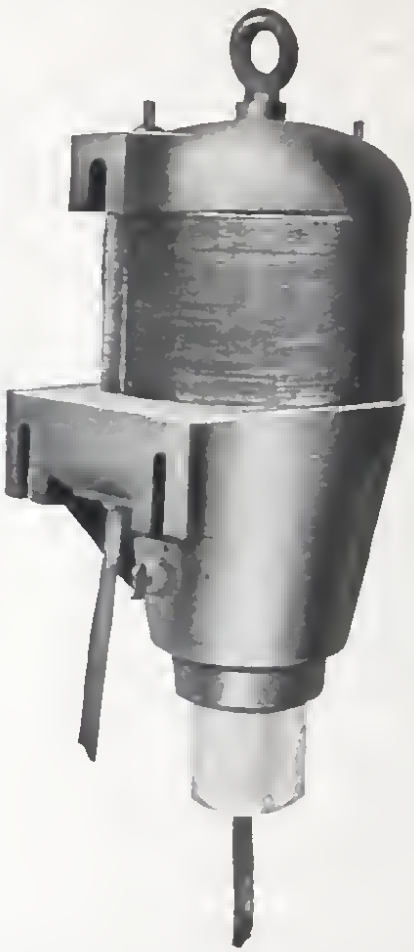


Fig. 49

60 CYCLE, 2 KV-A., 6.6 AMPERE, 1:1 RATIO, FORM A SERIES TRANSFORM

The SL transformers supersede the Type H Form S are designed for mounting on poles or in subways.

As the name implies, the subway transformers are for un ground use and are quite similar to the pole type except the leads are separated and brought to a cap or metal bush to which may be attached the lead sheath of the undergro cable. This cap or bushing is designed so that after the dered joint between the conductor is made and insulate can be filled with a hot insulating compound.

TYPE SL SERIES TRANSFORMERS

The SL transformers range in capacity from 40 to 2000 watts, and the standard ampere ratings are 4, 5.5, 6.6 and 7.5.

In general appearance and construction they resemble the telephone line insulating transformer.

The core is shell type, built up of circular punchings with two symmetrical pieces in each layer. On the center leg or tongue of this core are assembled the form wound coils. The primary coil fits snugly over the secondary coil but is so insulated that it will withstand a breakdown test of 20,000 volts to the secondary coil and also to the core.

The casing for the transformer consists of a cast iron box forming the lower part, and a cover or cap of the same material which forms the top. The case is conical in shape, being drawn in at the lower end to receive the large porcelain bushing through which pass the primary leads consisting of double-conductor rubber insulated cable. The secondary leads enter the case through a small porcelain bushing beneath the bracket near which is placed a grounding terminal. The core rests upon the upper edge of the case and upon the core rests the cover, modified slightly from the shape of a half sphere. Small studs through the cover and core bind these parts firmly together. The case has extension brackets for bolting the transformers to the cross arm of a pole or to the side of a building.

Because of the low capacity, and consequently small losses in the transformers, it was not found necessary to use oil as a cooling medium between the windings and the case.

INSTALLATIONS

Although recently developed the SL transformers are having a ready sale.

Among others they have been supplied to:

Rochester Railway & Light Co., Rochester, N. Y.

Gloucester Electric Co., Gloucester, Mass.

Yonkers Electric Lt. & Pr. Co., Yonkers, N. Y.

Suburban Electric Lt. & Pr. Co., Webster Groves, Mo.

New York Edison Co., New York, N. Y.

TYPE SL SERIES TRANSFORMERS

The following extract from the Dec. 29, 1910, issu
ELECTRICAL WORLD is illustrative of one of the applicat

LIGHTED FIRE ALARM BOXES IN ROCHESTER, NEW Y

"At a recent conflagration at night in the city of Ro
N. Y., it was brought out that the man who discovered t
made a conscientious attempt to turn in an alarm, bu
bewilderment and excitement could not remember wh
fire alarm box was located. As a result of this delay
gained considerable headway and caused serious loss
superintendent of the Rochester Railway & Light Co
reading the account in the daily papers and being,

Fig. 50

ELECTRICALLY LIGHTED FIRE ALARM BOX

Rochesterians, envious for the reputation of the Flower
immediately set about to devise a plan for making fire
boxes so conspicuous at night that a similar delay from
cause would not obtain.

"The scheme as planned by the company consists of lig
every fire alarm box with an incandescent lamp enclosed

TYPE SL SERIES TRANSFORMERS

LIGHTED FIRE ALARM BOXES IN ROCHESTER, N. Y. (Cont'd)

outer red globe. It was approved by the city engineer, who also became interested in the scheme, and incidentally gives the Rochester Railway & Light Company a gross income of $7500 a year.

"At present the 300 fire alarm boxes of the city are thus lighted. No change was made in the fire alarm posts, a special fitting at the top being equipped with a shade holder and a 40 watt, clear bulb, Tungsten lamp over which is a red globe with the words "Fire Alarm" etched in it. The lighting circuit to the post is run underground either from the underground system or from a pole line, the leads in the latter case passing down the pole in conduit to the fire alarm post. Where the lighting circuits are on the opposite side of the street the circuit is placed underground in an iron pipe, a single conductor being used for one lead and the pipe itself for the other lead. In this way the extra cost of a double conductor is saved and the small transformers—*for all the lamps receive energy from an overhead or underground 16 volt, 40 watt transformer connected to the constant-current arc lighting circuits*—are effectually grounded. The small transformers are in most cases set in the manholes adjacent to the fire alarm posts.

"In bringing a circuit from a transformer on a pole line it is usually possible to drive the conduit across the street without opening the latter, thus not only saving the expense of digging, but causing no inconvenience to traffic.

"Now every fire alarm box in Rochester is easily discernible at night for a great distance. When looking down a main thoroughfare the red lights thrust themselves into view like so many danger signs along a brightly lighted roadway, and the plan has given complete satisfaction ever since its installation a few months ago."

OPERATION

The primary winding is connected in series with the series arc or incandescent circuits so that under all conditions of load on the secondary, the primary winding carries the full current of the arc circuit which is maintained at its normal value by a constant current transformer.

For satisfactory operation of the incandescent lamps it is desirable to obtain as near constant current as possible in the secondary winding. It is, of course, impossible to obtain such current regulations under abnormal conditions of load, but with the open circuit voltage on the secondary not exceeding 150 per cent of the full load voltage and the current at 1, ¾ and ½ load not varying more than 2 per cent the operation of the transformer and lamps on the secondary has been found to be satisfactory.

The drooping characteristic in the secondary voltage of the transformer is for the purpose of limiting the open circuit voltage on the secondary and has been obtained by so proportioning the

TYPE SL SERIES TRANSFORMERS

OPERATION (Cont'd)

magnetic circuit that the section is contracted in several to permit saturation of the iron with no current in the secon

Primary windings are designed for the usual arc cur that is, 4, 5.5, 6.6 and 7.5 amperes. The ratio of transform generally has been 1.1, but there is no difficulty in winding primary or secondary for any reasonable current.

Type SL transformers are designed to operate continu at a temperature rise of 50 degrees. The approximate encies of the various sizes are as follows:

Kw.	Per C Effici Full L
0.04	8(
0.10	88
0.25	92
0.55	94
1.00	95
2.00	96

Several marked advantages appear in the SL transfo compared to the Type H Form S which it supersedes. instance, a 1 kv-a. SL transformer does not cost so m and has 45 per cent of the weight; no oil is required, an insulating compound which fills the case renders the transfo weatherproof. Furthermore, the core radiates its heat dir to the atmosphere through the edges of the exposed punch

CONNECTIONS

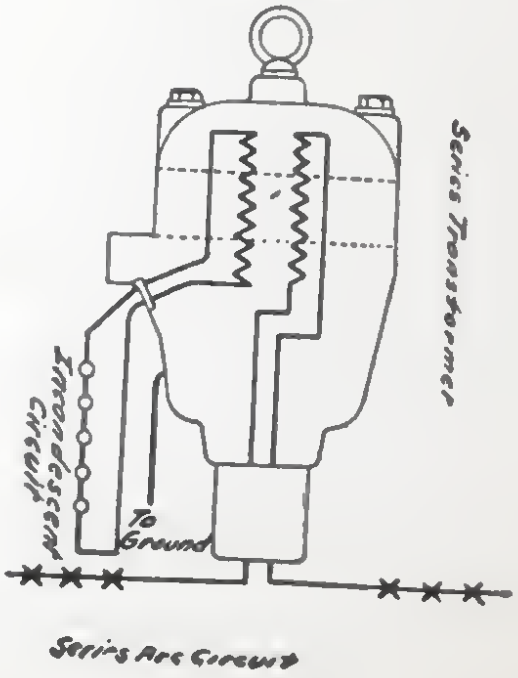


Fig. 51

TYPE SL SERIES TRANSFORMERS
FOR OPERATING SERIES INCANDESCENT LAMPS AT LOW-VOLTAGE ON 60 CYCLE SERIES ARC OR INCANDESCENT SYSTEMS

Cat. No.	Kw.	AMPERES		Ship. Wt. in Lb.
		Prim.	Sec.	
POLE TYPE				
78925	0.04	4.0	4.0	20
155944	0.10	4.0	4.0	40
78926	0.25	4.0	4.0	60
78927	0.50	4.0	4.0	75
78928	1.00	4.0	4.0	80
78929	2.00	4.0	4.0	100
78930	0.04	5.5	5.5	20
155945	0.10	5.5	5.5	40
78931	0.25	5.5	5.5	60
78932	0.50	5.5	5.5	75
78933	1.00	5.5	5.5	80
78934	2.00	5.5	5.5	100
78935	0.04	6.6	6.6	20
155946	0.10	6.6	6.6	40
78936	0.25	6.6	6.6	60
78937	0.50	6.6	6.6	75
78938	1.00	6.6	6.6	80
78939	2.00	6.6	6.6	100
155947	0.10	7.5	7.5	40
78940	0.25	7.5	7.5	60
78941	0.50	7.5	7.5	75
78942	1.00	7.5	7.5	80
78943	2.00	7.5	7.5	100
SUBWAY TYPE				
133557	0.04	4.0	4.0	20
155948	0.10	4.0	4.0	40
133558	0.25	4.0	4.0	60
133559	0.50	4.0	4.0	75
133560	1.00	4.0	4.0	80
133561	2.00	4.0	4.0	100
133562	0.04	5.5	5.5	20
155949	0.10	5.5	5.5	40
133563	0.25	5.5	5.5	60
133564	0.50	5.5	5.5	75
133565	1.00	5.5	5.5	80
133566	2.00	5.5	5.5	100
133567	0.04	6.6	6.6	20
155950	0.10	6.6	6.6	40
133568	0.25	6.6	6.6	60
133569	0.50	6.6	6.6	75
133570	1.00	6.6	6.6	80
133571	2.00	6.6	6.6	100
155997	0.10	7.5	7.5	40
133572	0.25	7.5	7.5	60
133573	0.50	7.5	7.5	75
133574	1.00	7.5	7.5	80
133575	2.00	7.5	7.5	100

The transformers listed above have been redesigned so that a protective device is not necessary.

TYPE SL SERIES TRANSFORMERS

DIMENSIONS

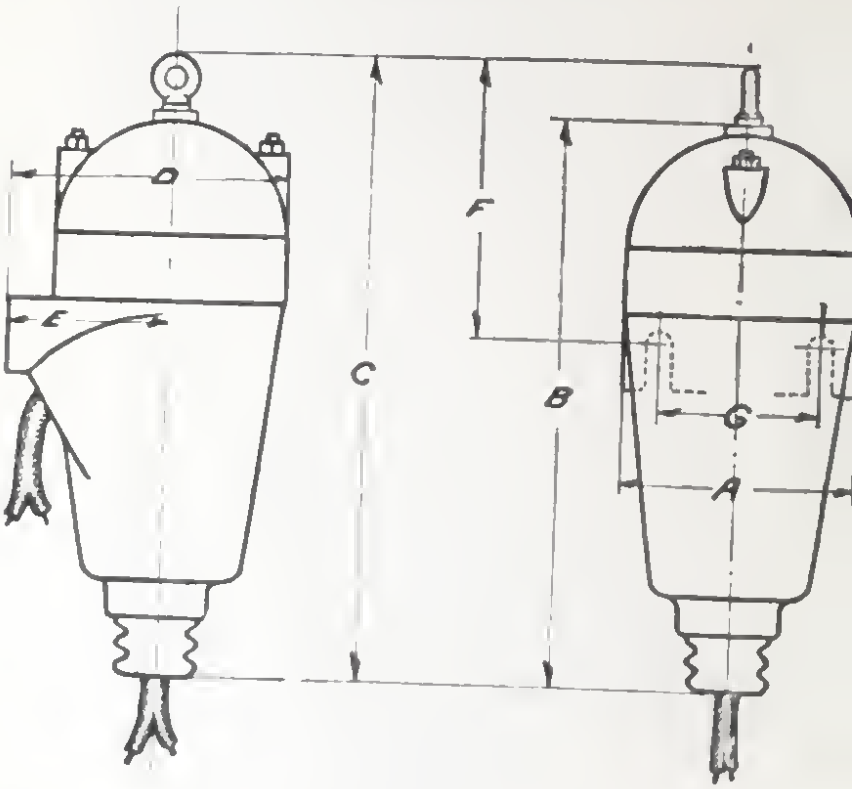


Fig. 52

Capacity	DIMENSIONS IN INCHES							APPROX IN LB	
	A	B	C	D	E	F	G	Net	S
0.04	4½	12	13½	5½	3¼	5¾	3	20	
0.10	4½	13⅛	14⅛	5½	3¼	6⅞	3	30	
0.25	7¼	14¾	17¾	8½	5	8	5⅜	40	
0.50	7¼	15¾	18¾	8½	5	9	5⅜	50	
1.0	7¼	17¾	20¾	8½	5	11	5⅜	70	
2.0	9	20¼	23	10¼	5¾	12½	6⅜	125	1

TYPE IL SERIES TRANSFORMERS

TYPE IL SERIES TRANSFORMERS
CHARACTERISTICS

	400 C-P.	600 C-P.	1000 C-P.
Efficiency	93.0	93.0	93.0
Power-factor	98.5	98.5	98.5

ADVANTAGES

A few of the advantages of these individual series transformers for ornamental street lighting systems are as follows:

As they insulate the pole and lamp from the high tension circuit, the use of series lamps is permitted in municipalities where ordinances are in force which prohibit high tension wires being carried on poles in the business district.

They save the expense of high-voltage conductors, heavy insulation and high tension absolute cutouts in the pole, a saving which materially assists in liquidating the difference between the first cost of auto-transformers and series transformers, the latter being naturally somewhat higher priced.

On account of the low secondary voltage of these series transformers the lamps are as safe to handle as if they were on a multiple circuit.

No film cutout is required as each lamp is independent o the others in the circuit. In case of an accident to one or more the remainder of the lamps on the circuit burn without interruption.

These series transformers allow the use of lamps where a series system is desirable and high potential impracticable, fo instance, where it is necessary to mount lamps upon telephone poles.

They also make it possible to provide lighting on bridge or other places where high potential is not allowed.

They protect the lamps from surges in the line.

They are a valuable adjunct to "Safety First" in ornamental street lighting.

DESCRIPTIVE AND GENERAL

The high efficiency of the 15- and 20-amp. MAZDA series lamps has made them very popular for street illumination. T operate them from standard 6.6- or 7.5-amp. constant curren series circuits individual auto-transformers have been commonl employed. Recently, however, due to a number of inheren advantages, there has been a considerable demand for a sma series transformer to operate a single lamp by stepping up th line current to the higher current required by the lamp.

TYPE IL SERIES TRANSFORMERS

DESCRIPTIVE AND GENERAL (Cont'd)

A complete line of this class of transformers has b
developed by the General Electric Company.

This line is divided into two general types, one being in
lated for operation on secondary circuits up to a maximum
5500 volts and the other up to a maximum of 10,500 volts.
high-voltage (10,500 volts) type is made both with and with
the casing being filled with compound (see Fig. 58). The l
voltage (5500 volts) type is not filled with compound.

The compound is an additional protection against moist
reaching the windings, and the transformers having this feat
should be recommended when installed where excessive moist
conditions exist. When transformers are used that are
compound filled in places where moisture conditions are seve
extreme care should be taken in wiping the joints in order
insure a watertight joint between cable and transformer.

These transformers are generally used for MAZDA or
mental street lighting, but they have many points which ada
them to numerous other uses.

While these transformers are generally mounted in the b
of ornamental poles, they can readily be mounted on a pole
cr ssarm, in a manhole or subway, or in any manner that lo
conditions may require. In fact, when convenience deman
the insulation is so perfect and the construction so watertig
and dampproof that they may actually be buried in the grou
When this is done, however, it is recommended that they
embedded in tar.

Figs. 54, 55, 56 and 57 show a few of the various methods
mounting. They are built in capacities of 225, 300 and 5
watts to take care of the 400, 600 and 1000 c-p. series MAZ
lamps. The standard primary windings are for 6.6 or 7
amperes, and the standard secondary winding is for 15 amper
(600 c-p.) or 20 amperes (600 and 1000 c-p.). Special prima
windings for any commercial circuits can, however, be supplie

CONSTRUCTION

These transformers are entirely enclosed in a drawn ste
casing, are absolutely waterproof, and all leads are broug
out through brass wiping sleeves so that the lead sheath of t
underground cable can be readily wiped on. The wipi
sleeves are heavily tinned to facilitate the lineman's work
making connections.

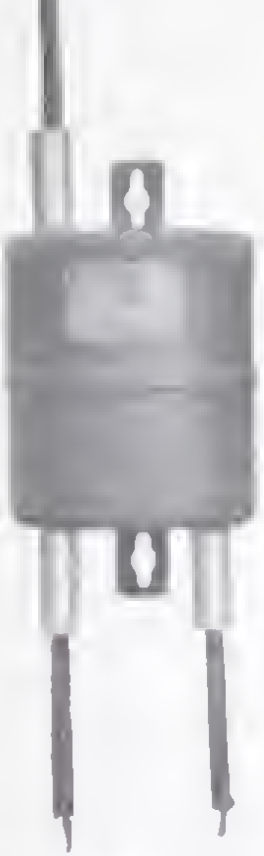
Each primary lead is brought out separately and a spa
of approximately 2½ inches is left between the prima
wiping sleeves. This makes the most convenient arrangeme
for connecting on primary leads, where, in the majority of case
a single conductor cable is employed.

While the standard arrangement of leads is to have th
two primary leads brought out at one end of the transform

TYPE IL SERIES TRANSFORMERS

CONSTRUCTION (Cont'd)

and the secondary leads at the other end, the internal arrange-ment is such that transformers can readily be built to meet any special requirement in the bringing out of leads. It is possible to furnish these transformers with the primary leads brought out through the wiping sleeves at the two ends of the transformer and the secondary leads brought out through



TYPE IL SERIES TRANSFORMERS

CONSTRUCTION (Cont'd)

225 and 300 watt transformers has been provided. This ta permanently brought out from the secondary winding in triple conductor on the secondary side. When installing tr former for MAZDA lamps, customer can wipe on a triple c on the secondary side, carrying this triple cable up to the la and taping up the third lead, which for the time being wo not be in use. Inasmuch as the secondary voltage of transformer is very low, this taping up of the third lead wo be perfectly safe. If, at any time in the future, improveme were made in the efficiencies of the lamps requiring reduced rent and customer desired to install them, it would be but work of a moment with a screw driver to change the connect at the lamp, and it would not be necessary to open any of wiped joints or disturb the transformers or leads in any w The casing for these transformers is made of drawn steel has a black weatherproof finish.

Electrically, these transformers are designed to meet most exacting requirements of this class of service and t will run continuously with the secondary open-circuited, there avoiding any possibility of trouble in case a lamp is brol or burns out. The design of the transformer is such that case of an open circuit the secondary voltage cannot rise more than approximately four times normal, so that the replac of a burned-out lamp is perfectly safe.

REGULATION

When lamp wattage varies between 8 per cent above a 20 per cent below normal, secondary current will not vary m than 1.0 per cent with normal primary current and frequen

PROTECTION

Primary current can go 75 per cent above normal witho increasing secondary current over 45 per cent.

All transformers insulated for 10,500 volt circuits take insulation test of 22,000 volts for one minute between prima and all parts. All transformers are given an insulation test 1500 volts from secondary windings to metal parts. The tra formers insulated for 5500 volt circuits are given a test of 12,0 volts for one minute between primary and all parts. These te are in accordance with the latest rulings of the A.I.E.E.

TYPE IL SERIES TRANSFORMERS

*For Operating 15- and 20-Amp. MAZDA Series Lamps on A-C. Constant Current Circuits

60 CYCLES

Cat. No.	LAMP RATING		Core Construction	ATTENUATION EQUIPMENT	
	K.V.P.	Amp.		Taps	Amp.
FOR OPERATION ON CIRCUITS UP TO 6600 VOLTS (Casing Not Filled with Compound)					
[illegible]7	4(X)	[illegible]	6 6	[illegible]	46
[illegible]8	4(X)	[illegible]	[illegible]	[illegible]	46
[illegible]9	5(X)	[illegible]	6 6	[illegible]	46
[illegible]0	[illegible]	0	[illegible]	[illegible]	46
[illegible]0	1(X)	[illegible]	6 6	[illegible]	60
[illegible]6	1(X)	20	[illegible]	[illegible]	60
FOR OPERATION ON CIRCUITS UP TO 10,800 VOLTS (Casing Not Filled with Compound)					
[illegible]0	4(X)	[illegible]	6 6	[illegible]	4
[illegible]	4(X)	[illegible]	[illegible]	[illegible]	4
[illegible]	6(X)	[illegible]	[illegible]	[illegible]	4
[illegible]1	6(X)	[illegible]	[illegible]	[illegible]	4
[illegible]4	1(X)	[illegible]	6 6	[illegible]	[illegible]
[illegible]5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FOR OPERATION ON CIRCUITS UP TO 10,800 VOLTS (Casing Filled with Compound)					
[illegible]1	4(X)	[illegible]	6 6	[illegible]	[illegible]
[illegible]4	4(X)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6(X)	[illegible]	6 6	[illegible]	[illegible]
[illegible]6	6(X)	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]5	[illegible]	[illegible]	6 6	[illegible]	[illegible]
[illegible]6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Special transformers can be furnished for operating current constant current circuits from 3 to 7 amperes, if so required.

† In order to provide for the possibility of future improvement in the efficiency of the MAZDA lamp, a tap has been provided on these transformers to give reduced current.

‡ No extra tap is provided on these transformers as their design will permit the operation of MAZDA lamps with maximum efficiency.

TYPE IL SERIES TRANSFORMERS
METHODS OF MOUNTING

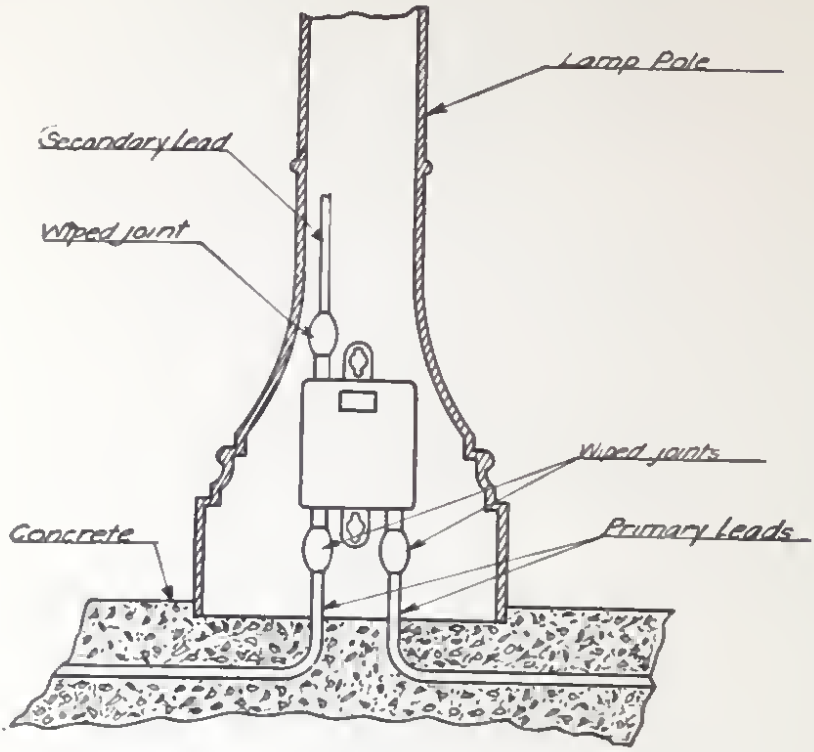


Fig. 54

SERIES TRANSFORMER MOUNTED IN POLE ON LUGS CAST IN BASE (FRONT VIEW

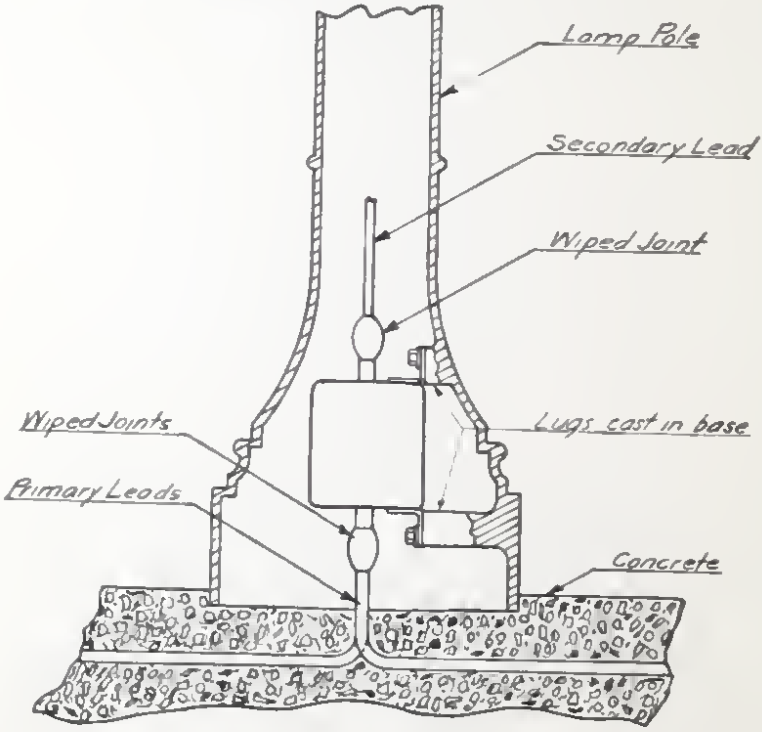


Fig. 55

SERIES TRANSFORMER MOUNTED IN POLE ON LUGS CAST IN BASE (SIDE VIEW)

TYPE IL SERIES TRANSFORMERS
METHODS OF MOUNTING (Cont'd)

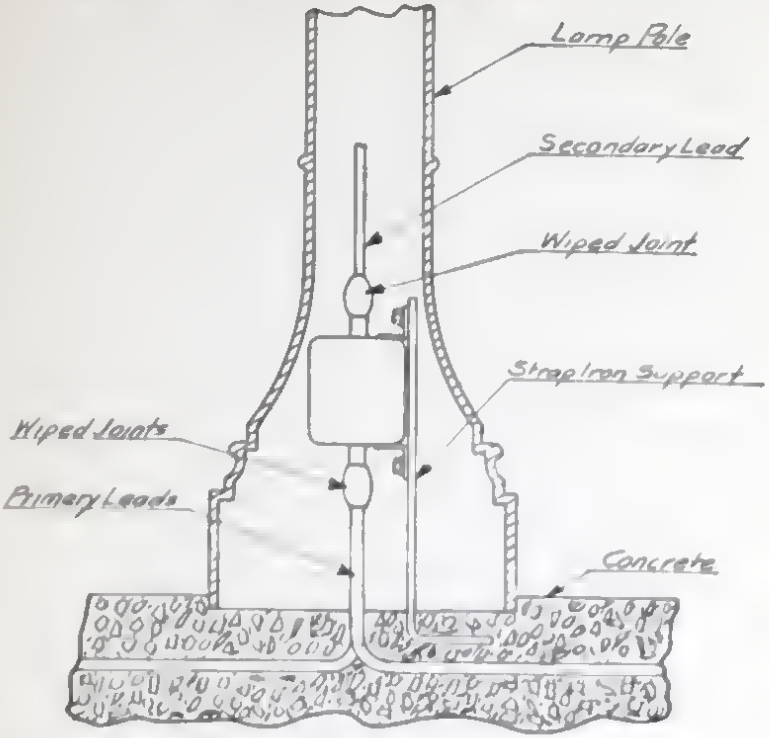


Fig. 56
SERIES TRANSFORMER MOUNTED IN BASE OF POLE ON STRAP IRON SUPPORT EMBEDDED IN CONCRETE

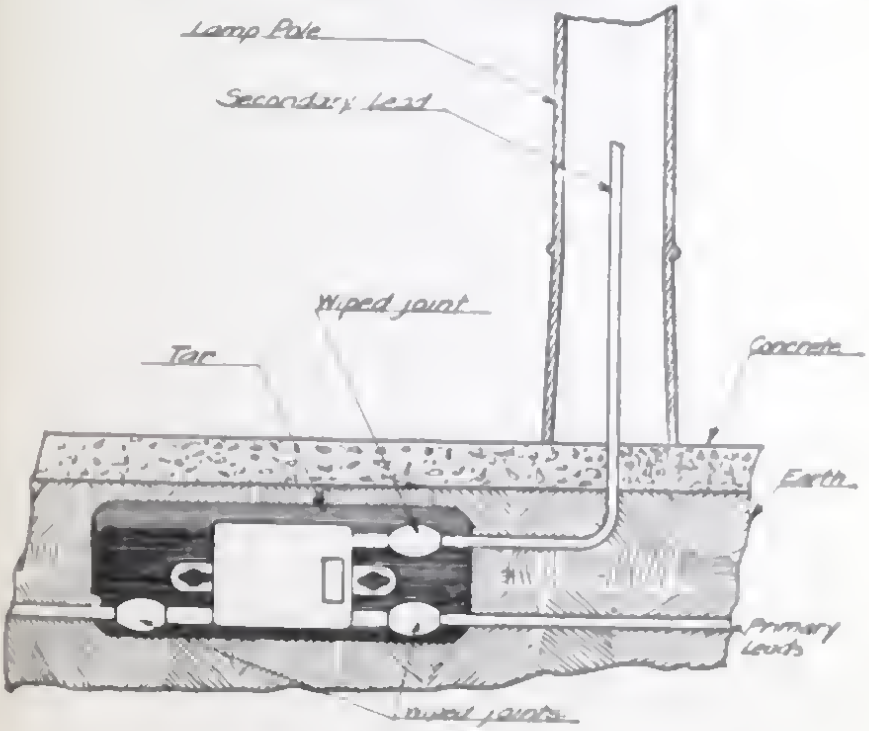


Fig. 57
SERIES TRANSFORMER BURIED IN GROUND

TYPE IL SERIES TRANSFORMERS

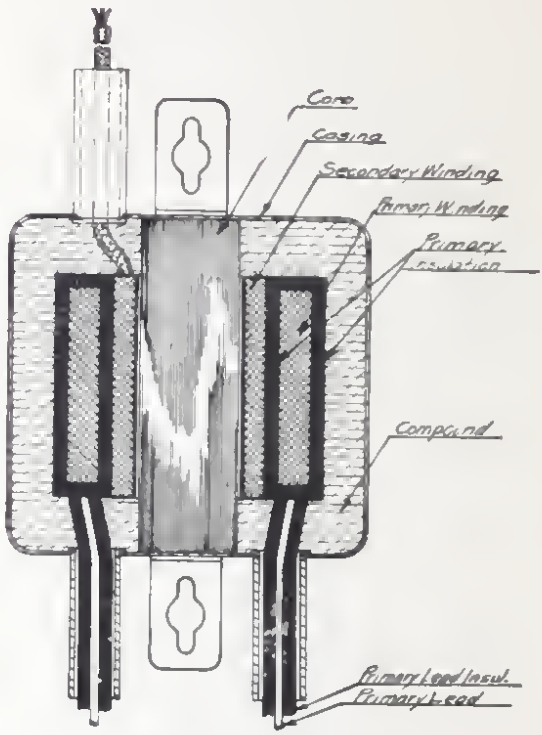


Fig. 58

SECTIONAL VIEW OF COMPOUND FILLED SERIES TRANSFORMER FOR 10,500 VOLT CIRCUIT

SERIES TRANSFORMERS

DIMENSIONS

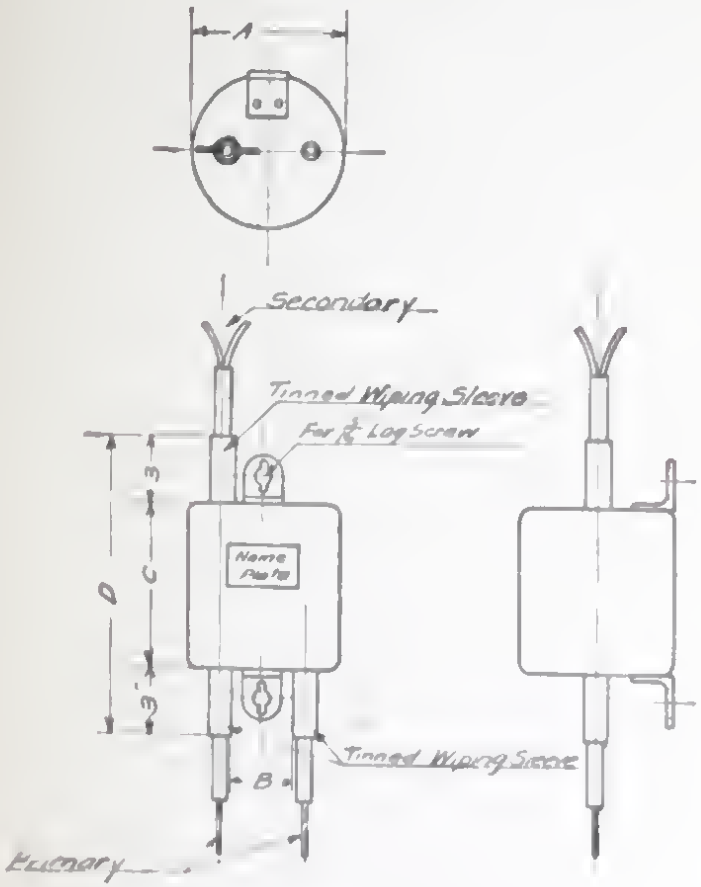


Fig. 59

W	DIMENSIONS IN INCHES			
	A	B	C	D
*300 †500	6 3/16	2 11/16	8 1/4	14 1/4

*Equipped with three secondary leads.
†Equipped with two secondary leads.